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J. H. GUIMARÃES & NELSON PAPAVERO: A TENTATIVE ANNOTATED BIBLIOGRAPHY OF *DERMATOBIA HOMINIS* (LINNAEUS JR., 1781) (DIPTERA, CUTEREBRIDAE)

DEPARTAMENTO DE ZOOLOGIA

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É o museu oficial de zoologia do Estado de São Paulo. Compreende coleções seriadas da fauna brasileira, uma exposição pública, biblioteca especializada e a Estação Biológica de Boracéia.

Histórico:

1890. O Conselheiro F. de Mayrink doa ao Govêrno do Estado o acêrvo do Museu Sertório, que adquirira do seu organizador, o Coronel J. Sertório. (Diretor: A. Löfgren). Donation to the State Government of the J. Sertório private collection; director A. Löfgren.

1893. O referido acêrvo é incorporado à Comissão Geográfica e Geológica, constituindo sua Secção de Zoologia (Chefe: H. von Ihering). Collections transferred to the State Geographical and Geological Commission, Zoological Section, head H. von Ihering.

1894. As Secções de Zoologia e de Botânica destacam-se da Comissão Geográfica e Geológica, dando origem ao Museu Paulista (Diretor: H. von Ihering). Sections of Zoology and Botany detached from the State Geographical and Geological Commission to form the Museu Paulista, director H. von Ihering.

1939. A Secção de Zoologia do Museu Paulista separa-se e transforma-se no atual Departamento de Zoologia (Diretores: S. de T. Piza Junior, 1.II — 18.IV.1939; O. M. de O. Pinto, 20.IX.1939 — 9.II.1956; Clemente Pereira, 5.III.1956 — 30.X.1958; Lindolpho Rocha Guimarães, 1.XI.1958 — 29.X.1962). Section of Zoology detached from Museu Paulista to form the Departamento de Zoologia (Directors, S. de T. Piza Junior, 1.II — 18.IV.1939; O. M. de O. Pinto, 20.IX.1939 — 9.II.1956; Clemente Pereira, 5.III.1956 — 30.X.1958; Lindolpho Rocha Guimarães, 1.XI.1958 — 29.X.1962).

Publicações científicas

O Departamento publica duas revistas, Arquivos de Zoologia do Estado de São Paulo (publicação iniciada em 1940) e Papéis Avulsos do Departamento de Zoologia da Secretaria da Agricultura de São Paulo (1941). Os artigos são publicados individualmente e trazem indicada a data de sua distribuição aos autores e centros bibliográficos, sendo enfeixados em volumes sem periodicidade certa.

Anteriormente, os artigos zoológicos do Museu Paulista eram publicados na Revista do Museu Paulista. Com a fundação do Departamento de Zoologia, os volumes 1 e 2 dos Arquivos de Zoologia traziam as indicações, respectivamente, de volumes 24 e 25 da Revista do Museu Paulista. Esta prática foi abandonada, visto continuar essa revista sua publicação como Nova Série, dedicada a assuntos estranhos à Zoologia.

Scientific publications

The Departamento publihes two periodicals, Arquivos de Zoologia do Estado de São Paulo (publication started 1940) and Papéis Avulsos do Departamento de Zoologia da Secretaria da Agricultura do Estado de São Paulo (1941). Papers are

individually published and show the date of distribution to authors and bibliographical centers, being eventually assembled into volumes.

Prior to 1940, zoological papers of the Museu Paulista were published in the Revista do Museu Paulista. When the Departamento de Zoologia was founded, volumes 1 and 2 of Arquivos de Zoologia had the indication "volumes 24 and 25" of the eRvista do Museu Paulista. Such practice was subsequently abandoned, as that periodical continued publication as a "New Series" (Nova Série).

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A TENTATIVE ANNOTATED BIBLIOGRAPHY OF *DERMATOBIA HOMINIS* (LINNAEUS JR., 1781) (DIPTERA, CUTEREBRIDAE)

J. H. GUIMARÃES
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INTRODUCTION

In the past decades many important and outstanding works on different groups of medically or economically important Diptera were written in several countries, but up to now no effort has been made to

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bring together available information on *Dermatobia hominis* (L. Jr.), the human warble-fly, one of the most serious pests of cattle in the Americas south of the United States.

The fascinating study of this insect attracted the attention of many entomologists and non-entomologists during the past three centuries; however, information is usually fragmentary, frequently contradictory. Some facts are frequently repeated, while many aspects were never satisfactorily investigated.

Here we intend to assemble all the available literature references we have gathered to date concerning *D. hominis,* as a foundation for future research and as an effort to stimulate work on the still unknown points of the unique biology of this fly.

We do not pretend that this bibliography contains all the existing references to *Dermatobia.* It is a "tentative" bibliography. We have tried, however, to assemble as many references and citations as could be located. The following bibliographical sources were consulted: Zoological Record, Biological Abstracts, Index-Catalogue of Medical and Veterinary Zoology (which we found to be the most complete compilation), Review of Applied Entomology (series B), Bulletin Signalétique d'Entomologie Médicale et Vétérinaire, Index Veterinarius, Veterinary Bulletin, Bibliografia Brasileira de Medicina, Índice-Catálogo Médico Brasileiro and Índice-Catálogo Médico Paulista.

The first nine introductory chapters of the present work deal with the current knowledge of the general biology of the fly and its systematics. All pertinent papers are cited in each chapter, but a critique is made only of those which seem to us to contain relevant information.

The bibliography proper is arranged chronologically and numbered in sequence and those numbers are referred to in the introductory chapters. Treatises or handbooks of parasitology, medical entomology and related sciences were not listed, except for a few special cases. Also, due to library limitations and to the fact that most of the literature on *Dermatobia* is too much scattered through periodicals not always easily available, we have not had the opportunity to consult a number of references. References not discussed do not seem to us to present any special interest, being in most cases popular articles on the general biology of the fly, control methods, etc.

It is our pleasure to acknowledge the help of the following individuals, who greatly aided us during the preparation of this bibliography: Drs. P. E. Vanzolini, L. R. Guimarães, O. M. de Oliveira Pinto, M. Carrera — Departamento de Zoologia da Secretaria da Agricultura do Estado de São Paulo; Dr. Mário Neme — Museu Paulista, Universidade de São Paulo; Drs. H. Souza Lopes and S. J. de Oliveira — Instituto Oswaldo Cruz, Rio de Janeiro, Guanabara; Dr. Charles E. Dibble, Department of Anthropology, University of Utah; Drs. Borys Malkin, Kenji Iryo and David Edmonds; Dr. Curtis W. Sabrosky, U. S. Department of Agriculture, Agricultural Research Service, Entomology Research Division.

We welcome any criticisms and suggestions, as well as additional references.

1. HISTORY OF RESEARCH

The development of research on *Dermatobia* can be divided into six periods.

1. From 1626 to 1820: includes reports by missionaries, physicians and naturalists travelling in South America (1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 16). Linnaeus Jr. (9) named the species "*Oestrus hominis*", in a letter addressed to and published by Pallas. In this letter he said that in South America there existed a fly which laid its eggs or living larvae in the human skin, one after another. Those larvae were carried over its abdomen, and burrowed immediately in the human skin, taking half year to develop. When left in peace, they would emerge by themselves, falling to the ground and finally becoming a blackish fly — *Oestrus hominis.*

These first records of the existence of such a fly (including the brief description of its biology by Linnaeus Jr.) were disbelieved in Europe, either because some other species of oestrids could accidentally parasitize man in European countries, or it would not be possible that there was an exclusively human botfly (for a good historical resumé of these accidental cases of human parasitism by oestrids see Kefersтein — reference 36).

2. The second period, from 1822 to 1892, is characterized by a proliferation of papers describing and reporting every larva found (17, 18, 19, 20, 23, 24, 25, 26, 28, 30, 31, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 49, 50, 53, 54, 55, 56, 58, 59, 60, 61, 62, 63, 64, 66, 68, 69, 70, 71, 72, 73, 74, 76). Authors frequently disagreed as to detais of larval morphology and especially as to how many species should be accepted. Blanchard (73) compiled all published descriptions and reports (inclusive illustrations) and decided, based on larval characters alone, that *four* different species existed, which he called by their common names: *ver macaque, berne, torcel,* and *ver moyocuil.*

Macquart (29) described for the first time the adult fly as *Cuterebra cyaniventris,* entirely unaware that it was the adult of the "Oestrus" reported from South America as living under the skin of men and animals. One of the most important events of this period was Goudot's success in rearing an adult fly from pupae collected in Colombia. The fly was described by him as *Cuterebra noxialis* (31). The genus *Dermatobia* was then erected by Brauer (41) for the reception of "both" species (*cyaniventris* and *noxialis*) (see chapter 4).

3. In the third period, from 1893 to 1910, several important contributions were made — the identity of *cyaniventris* and *noxialis* established (84, 89) and the first efforts made to rear the larvae to adult-

hood (109, 111, 114). Although some phases of the biology were discovered, it still remained a mystery how larvae could be transmitted to the hosts. A variety of insects, mostly mosquitoes, were incriminated by lay people and in the literature. It was believed that eggs were laid directly on the skin (5, 6, 9, 13, 14, 16, 53, 56, 58), directly on clothes (76), over leaves, thence being transported by mosquitoes (122), or that the larvae crawled onto the body of the host from the ground (17).

4. The problem was solved and the solution confirmed by several authors (113, 114, 116, 117, 121, 122, 125, 130, 133, 134, 143, 147, 148), in the fourth period, from 1911 to 1918. The first to demonstrate that *Dermatobia* eggs were carried by mosquitoes, however, was undoubtedly Morales (114). Neiva (111) established that *hominis* and *cyaniventris* (= *noxiablis*) were synonyms.

5. In the fifth period, from 1918 to 1943, no major discovery was made, but many details were added to the general scheme of the fly's biology — the male (203, 210) and the female (155, 210) genitalia were described, the common characteristics of the vectors analyzed (247) and a theory on the intermediate oviposition suggested (214). The first attempts to control the fly (160, 161, 162, 165), some new records of vectors (157, 163, 173, 174, 195, 196, 197, 206, 216, 220, 225, 227, 241), morphological details (171) and descriptions of myiases of man and animals (151, 152, 153, 164, 168, 170, 174, 178, 179, 180, 181, 182, 184, 186, 187, 188, 191, 193, 198, 199, 207, 208, 219, 221, 228, 230, 231, 233, 237, 244) were published.

6. Finally, from 1943 to the present, preoccupation is shown almost exclusively with control by means of several insecticides (248, 249, 259, 260, 261, 269, 270, 271, 276, 278, 280, 281, 283, 286, 290, 291, 292, 293, 294, 296, 297, 299, 300, 301, 302, 304, 305, 308, 310, 315, 319, 324, 327, 328, 332, 333, 335, 337, 338, 339, 340, 341, 342, 343, 344, 345, 348, 349, 350, 351, 353, 354, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 368, 369, 370, 374) and with the economic, medical and veterinary importance of the fly (250, 251, 254, 255, 256, 257, 258, 262, 264, 268, 279, 282, 288, 289, 295, 298, 307, 316, 317, 318, 321, 323, 325, 329, 336, 346, 347, 367, 370). The first account of the mating behaviour was published by Guimarães (375).

2. COMMON NAMES OF *DERMATOBIA*

Dermatobia hominis is known by many common names — in English it is commonly referred to as the American, human or tropical warble- or bot-fly. In addition, there are several regional names, here presented in alphabetical order:

1. *"Beef-worm"*, Guatemala (222).
2. *Bekuru* or *bikuru*, among the Kaingang Indians of Brazil (156).
3. *Berne*, Brazil. This is a word of uncertain origin. Neiva & Belisario Pena (137) believed that it could be a corruption of the Portuguese "*berro*", applied in Portugal to the larvae of *Hypoderma*. The word "*berro*" is used in Brazil, too, but serves to designate the larvae of *Philornis pici* (Diptera, Muscidae). On the other hand, Araripe Jr. wrote to Blanchard (89) that "la larve que nous appellons *Berne* porte aussi le nom de *Verme*: cette coincidence nous autorise à considerer le premier nom comme une double corruption du second. Dans le nord du Portugal, le peuple prononce *Berme* au lieu de verme: or, la plupart des Portugais qui arrivent au Brésil viennent du nord du Portugal, et leur pronunciation vicieuse a été adopté dans les campagnes, où la maladie est frequente. Quant à la transformation de *Berme* en *Berne*, elle s'explique naturellement par la loi que les philologues appellent 'loi du moindre effort'".
4. *Borro*, Bolivia (342).
5. *Colmoyote*, Mexico and Guatemala (114). From the Náhuatl *ocuilin* = worm, *moyotl* = fly; (o)*cuil*(in)*moyotl* — colmoyote = worm of the mosquito (355). See also Moyocuil.
6. *Gusano macaco*, Venezuela (117). See Ver macaque.
7. *Gusano de monte*, Central America, Ecuador, Colombia and Venezuela. "Worm of the forest" : refers to the fact that infestation by *Dermatobia* larvae is more frequent in the neighbourhood of forests.
8. *Gusano de mosquito* or *gusano de zancudo*, Venezuela. "Worm of the mosquito": obviously refers to the fact that *Dermatobia* eggs (or better, larvae = gusanos) are transmitted by mosquitoes.
9. *Gusano peludo*, Bolivia (7). "Hairy worm": possibly applied to the hairy (spiny) appearance of the larva.
10. *Kturn*, *kitudn* or *ikitugn*, among the Kaingang Indians of Brazil (156, 243).
11. *Mberuaró*, name given by Guarani Indians to the adult fly. From *Mberu* = fly, *ñaró* = angry (177).
12. *Mirunta*, Peru (76). The name seems to be given to the disease caused by *Dermatobia*, and not to the fly itself.
13. *Moyocuil*, Mexico (38). According to Dr. Charles E. Dibble, this word is formed by *moyotl* = mosquito and *ocuilin* = worm; *moy*-(otl)*ocuil*(in). See also Colmoyote, and reference 365.
14. *Muskietenworm*, Surinam (35).
15. *Nuche* or *nunche*, Colombia and Venezuela (17, 31, 56). Meaning unknown.
16. *Suglacuru* or *suylacuru*, cited by la Condamine (4) as used by the Mayna Indians. Perhaps from the Quechua *sugla* or *suyla* = ? and *curu* = worm or insect.
17. *Torcel* or *tórsalo*, Central America. Probably a corruption of the Spanish "torcer" (to twist) (39, 243).

18. *Tupe*, Ecuador (214). Meaning unknown.
19. *Ura*, Brazil, Argentina, Uruguay and Paraguay. A word from the Guarani language. Cited by Montoya already in 1629 (2).
20. *Ver macaque*, French Guiana. Following Arture (5): "cet insecte est du genre de ceux qui se trouvent sous la peau des animaux (...). On en voit assez fréquemment sur l'espèce de singe qui est la plus commune en France, et c'est probablement de cet animal, qui se nomme en langue du pays, Macaque, que le ver a pris son nom."

3. INSETS WHOSE ADULTS HAVE BEEN WRONGLY ASSOCIATED WITH THE LARVAE OF *DERMATOBIA*.

The definite association of larval and adult *Dermatobia* has required a tremendous effort of patient observation and experimentation by many workers. Lay people, however, have ignored and still ignore the identity of the adult fly and accuse a variety of insects as responsible for the larvae of *Dermatobia*.

Blanchard (82) was the first to record such popular beliefs. The insects mistaken for *Dermatobia* were sent to him by P. S. Magalhães, from Brazil. Blanchard lists the following species of Diptera: *Ornidia obesa* (Fabricius), Syrphidae; *Phaenicia eximia* (Wiedemann), as *Lucilia ruficornis* Macquart, Calliphoridae, *Paraphryssopoda chrysostoma* (Wiedemann) and *Hystricocnema plinthopyga* (Wiedemann), both as *Sarcophaga*, Sarcophagidae; *Hystricia* sp., Tachinidae, and Tipulidae.

Altamirano (87) cites *Atractocerus brasiliensis* Lep. & Serv. (Coleoptera, Atractoceridae), in Mexico. We have not seen this reference, and quote from Neiva (111). Rondon cites a mosquito, "carapanã de ura" (107). Finally, Neiva (111) lists *Ornidia obesa* (Fabricius), Syrphidae; *Mesembrinella* sp., Calliphoridae, and Tipulidae. These latter are known, at least in some parts of Brazil, as "mosquito berne". In a later paper (130) Neiva says, without further comment, that the "carapanã de ura" is an ichneumonid (Hymenoptera) and adds to the list of "wrong" *Dermatobia* the tachinid *Echinomyia* sp.

As can be deduced from the above quotations, mistaken associations may arise from a diversity of causes, among which morphological similarity (e.g., *Ornidia obesa*, *Mesembrinella*), incrimination of vectors (e.g., mosquitoes) and similarity of habits (e.g., myiases-producing calliphorids).

4. SYSTEMATIC POSITION

Dermatobia Brauer

Dermatobia Brauer, (1861): Verh. zool. bot. Ges. Wien 10: 783. Type-species, *Cuterebra cyaniventris* Macquart (by the present designation) = *hominis* (Linnaeus Jr.).

Dermatobia hominis (Linnaeus Jr.)

Oestrus hominis Linnaeus Jr. in Pallas, 1781: Neue Nord. Beytr. 1: 158. Type-locality: "Peru"; Gmelin, 1788: Syst. Nat. Ed. XIII, 1 (5): 2811.

Oestrus humanus Howship, 1833: Proc. Royal Soc. London 12: 181. Type-locality: Mariquita, Colombia.

Oestrus guildingii Hope in Owen, 1833: Catalogue (?). Type-locality: Trinidad.

Cuterebra cyaniventris Macquart, 1843: Dip. exot. 2 (3): 23. Type-locality: Brazil.

Cuterebra noxialis Goudot, 1845: Ann. Sci. Nat. (3) 3: 229, pl. 4bis, figs. 1-6. Type-locality: Marmato, Colombia.

Dermatobia cyaniventris; Brauer, (1861): Verh. zool. bot. Ges. Wien 10: 783.

Dermatobia noxialis; Brauer, (1861): Ibidem: 783.

Dermatobia hominis; Ward, 1903a: Mark Anniv. Vol.: 483; 1903b Studies Lab. Nebraska 58: 1; Neiva, 1910: Chácaras e Quintais 2 (1): 3.

The name of this species has aroused much argument. As we have seen in the first chapter, Linnaeus Jr. (9) named it *Oestrus hominis*. It seems probable that Linnaeus Jr. saw neither the adult nor the larva. His biological characterization of the form was brief, but sufficient to prove that the species in question was *D. hominis*.

Although the name *Oestrus hominis* was included by Gmelin (11) in the thirteenth edition of the *Systema Naturae* and afterwards used by a few subsequent authors, the majority ignored it.

The larva was named by Howship (23) as *Oestrus humanus*. Hope (28) cites in Table III of his paper (case 18, caused by *Oestrus*) the name *Guildingii* Hope, further noting: the larva had been obtained by Guilding, in Trinidad, from the head of a man and was deposited at the Royal College of Surgeons of England. From the same source, the species (*guildingii*) had been described by Hope in "Owen's Catalogue", with a figure by Curtis. Most possibly, the work referred to as "Owen's Catalogue" is the "*Descriptive and illustrated Catalogue of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London* by Sir Richard Owen, 1833. As we have not had the opportunity to consult this very rare book, it was not included in the bibliography, and the nomenclatorial reference above was left incomplete. The type-specimen of *Oestrus guildingii* Hope, deposited at the Royal College of Surgeons of England, has been probably lost, since Blanchard was not able to locate it among the collections, in 1892 (72).

Excepting for the brief account of the adult, given by Linnaeus Jr., only larvae were known until 1833. Macquart (29) described the adult fly for the first time, as *Cuterebra cyaniventris,* including it in his "Tribu des Oestrides". Two years later, Goudot (31) described an adult, under the name *Cuterebra noxialis.* Brauer (41) erected the genus *Dermatobia* for the reception of "both" species, without selecting one as the type. The genus was included into the Oestridae, next to *Cuterebra* Clark.

Austen (84) and Blanchard (89) have independently established the synonymy between *cyaniventris* and *noxialis,* and finally Neiva (111) established the synonymy between *hominis* and *cyaniventris.* Ward (97,98) used the combination *Dermatobia hominis* seven years before Neiva, but as we have not seen his original papers, we are not sure about what he actually wrote.

Altamirano (87) said that the species had been described also by Serna, as *Dermatobia mexicana,* in a doctoral thesis. As nobody has a good citation of this thesis, we have not included neither the name proposed nor the thesis in the nomenclatorial references above.

Apparently, Townsend was the first to give the Cuterebridae family-rank (144), including *Dermatobia* in the subfamily Dermatobiinae. Townsend's position was not followed by immediately subsequent authors; modern ones, however, are unanimous in accepting *Dermatobia* as member of the family Cuterebridae.

Zumpt (334) proposed a new classification, including the *Cuterebra*-group in the Calliphoridae, subfamily Cuterebrinae. This position was modified in the same paper, on account of Bennett's quoted arguments.

Bennett (*in* Zumpt, 334) pointed out that the cuterebrids were possibly in the original ancestral line from which the oestrids evolved, several important primitive characters being found in the former family. Patton (210) making a comparative study of the genitalia of *Dermatobia, Cuterebra* and *Hypoderma,* concluded that *Dermatobia* should be regarded as the most primitive of the three genera, *Cuterebra* occupying an intermediary position. Furthermore, *Dermatobia* is known as fossil from the Paleocene of Colorado, United States (for complete references, see Townsend, 246).

5. MORPHOLOGY

5.1. Adult

We have adopted Townsend's description of the adult fly (214), completing it with details (between parentheses), from the same author, in another paper (226).

"Body rather narrowed, not pilose; coloration greenish on the thorax to bluish, purplish or violet on the abdomen. Head somewhat wider than high, its profile flattened subtriangular but rounded below, frontal profile arcuate; clypeus short, deeply sunk, no facial carina;

epistoma strongly narrowed, shorter than clypeus, warped forward and then downward in vertical plane; facialia wide, steeply oblique and bare; (parafacialia wide as clypeus and haired below) ; vibrissae absent, vibrissal axis scarcely shorter, vibrissal area swollen and hairy; proboscis reduced, rostrum recessive, haustellum not twice as long as thick, labella small but distinct, no palpi; antennal axis well above eye middle and 2/3 head height, bases of antennae approximated, first joint flush, second joint short, third joint elongate (about 3 times second, but rather longer in male and slightly wider in female), arista long pectinate; eyes bare and small, front wide and much produced, all head bristles aborted, frontalia very wide and thickly setose, ocellar plate reaching nearly to lunula, occipital orbits micro setose, cheeks very wide (3/4 to nearly eye length) and grooves large."

"Infrascutellum recessive, lateral postscutellar plates bare, prosternum and its somewhat inflated membrane bristled, propleura pilose, prescutum distinctly longer than postscutum, postallar wall bristled posteriorly and on middle of upper edge, tympanic ridge long pilose and pit bare, ampullae approximated and the smaller differentiated from the rim of postparaptéron; greater ampullae large, raised, ovoreniform. Thoracic bristles aborted, pteropleura thickly set with bristly hairs, sternopleura with several differentiated hairs, hypopleura with long hairs. Stigma short but longer than radio-costa, prestigma larger than poststigma, 5R open well before wing tip, S2 ending at half wing length, R3 and R5 well inside tip of S2, M3 practically coincident with cubitulus, alulae erect but small, squamae subtriangular and narrowing posteriorly. Legs moderately, femora rather swollen basally and tibia rather short and straight. Abdomen ovate, basisegment short, no macrochaetae, sternites exposed and first little wider than second, ventral membrane exposed."

According to Patton (210) : "The spiracles are located on the terga closer to their ventro-lateral edges. Spiracle VI lies in the membrane just anterior to tergum VI and spiracle VII is located on the antero-lateral edges of tergum VII. Tergum VI is a large rounded plate forming with tergum VII the tip of abdomen; tergum VII is closely applied to it, but is shorter. Sternum VI is a short, rather wide plate lying in the middle line above sternum V and concealed by it."

Returning to Townsend's descriptions (214, 226) : "Male hypopygium small, genital area subcircular and ventral. (Male first hypopygial tergite or fused sixth and seventh tergites crescentlike and enclosing the separate and less strongly crescentic eigth tergite of nearly same length, each about 1/4 length of fifth tergite or anal segment; second hypopygial or ninth sternite little longer than each of preceding, including its appendages; anal forceps very short, widened on base, entirely separated and with pointed tips, subtriangular, haired, the periproct lying between their bases; tenth sternite lobes wide basally

narrowed terminally into short fingerlike forceps longer than anal forceps and enclosing latter; fifth sternite heart shaped and widened posteriorly, scalloped on hind edge; gonapophyses broadly toothlike); aedeagus very similar to Cuterebrini (black and chitinous, subcylindric, bowed and retractile within membranous pads fitting into emarginations of fifth sternite; phalloteca slender cylindric, phallus stouter and distinctly fluted longitudinally, indicating the paraphalli and hypophalli, ventralia chitinous but simple, preaputium enclosed by tips of hypophallus prongs at the subtruncate phallus tip which is completely rimmed with a colorless membranous corona)".

"Female hypopygium ventral, genital area smaller than that of male, the parts terminating in a finely haired tubercle partially encircled when at rest by the eighth tergite and showing three divisions, the lateral ones being the aborted anal cerci while the middle one is the ninth tergite, close ventrad of which is the ninth sternite."

Patton (210) also described and figured the female terminalia, adding: "the arthrodial membrane joining the terga is longer than the one joining the sterna, thus permitting the ovipositor to be bent under the abdomen of insect carriers. The ninth sternum has a characteristic distal groove, which would permit the sclerite to be placed against a raised object and would allow eggs to be placed in a small heap. I have not been able to find any distinct anal opening. The genital opening is a wide slit. The spermathecae are small, round and partly pigmented."

5.2. Immature stages

Immature stages, especially larvae, have been described, although imperfectly, by several authors (17, 19, 23, 28, 31, 37, 38, 39, 41, 43, 44, 54, 66, 72, 78, 82, 88, 89).

Eggs were described by Townsend (214) as "medium macrotype, whitish, elongate, curved, subcylindric, rather stout at cephalic end and gradually tapered to anal end, without pedicel; chorion medium thick, longitudinally striate, without true operculum but with longitudinal cleavage seam at cephalic end."

Larva I was described by Surcouf (122), but the best description was given by Newstead & Potts (171), as follows: "somewhat elliptical in general outline, bluntly rounded anteriorly and gradually attenuated posteriorly, the width of the last two segments being approximately half the width of the mid-thoracic segment, as seen in profile, after maceration in caustic potash."

"The cephalic segment is scantly covered with very minute spines; these appear to be more numerous dorsally and bilaterally. The first thoracic segment bears a continuous band of relatively small and closely set black spines. The second and third thoracic segments are

completely clothed with similar spines. First, second and third abdominal segments show a double transverse series of large spines dorsally, and a single series ventrally; the interspaces are set with smaller spines which are much more numerous in the posterior series than in the anterior one. The fourth to sixth segments inclusive are spineless. The seventh segment is clothed with long and slender, translucent spines. The terminal segment is almost covered with relatively strongly hooked and translucent spines."

"The spines on the thoracic and first three abdominal segments are directed backwards, whilst those of the last two segments are directed forwards. This arrangement of the posterior groups of the spines enables the larva to retain a firm hold of the inner walls of the egg-shell after partial emergence."

"The main tracheal tubes of the respiratory system, which resists the action of caustic potash, show very clearly. On the other hand, the posterior stigmata are minute and not very clearly defined; they communicate with the tracheal trunks by two long and slightly narrower fit chambers which extend to the middle of the penultimate segment."

"The antennal organs, presumably corresponding to the antenno-maxillary organs of other Dipterous larvae as described by Keilin (1915) are placed well forward in the cephalic segment in a dorso-lateral position; the proximal portion of the organ is strengthened with an incomplete band of dark chitin, the terminal portion being translucent."

"The mouth parts:

(i) The mouth hooks. — These are highly chitinised, blackish and strongly falciform structures, the inner edge being finely though somewhat irregularly serrated. Proximally, the anterior portion is strongly produced. There are two centrally placed foramina.

(ii) The "prestomal sclerites" — These appear to consist of very thinly chitinised, translucent plates, which may act as a sheath to the tips of the mouth hooks (...).

(iii) The stomal plates. — These are relatively large cone-like processes, converging distally, and with longitudinal but somewhat indefinite ridges; proximally these structures are partly surrounded by a strongly chitinised plate, which is toothed on its distal or anterior margin. Below the cones is a mass of tissue with an irregular outline, portions of which seem to bear chitinous bodies, possibly muscle attachments.

(iv) Membranous bands. — These very thin and very slightly chitinised structures appear to arise towards the base of the mouth hooks; they are covered, and directed outwards and slightly backwards, the tips in some cases being slightly curved inwards, and somewhat strongly chinitised.

(v) Hypopharingeal sclerite. — This consists of a median and very thinly chitinised plate with a pair of sub-median foramina, and lies between the anterior processes of the cephalo-pharyngeal sclerite, at the articulation with the mouth-hook.

(vi) Cephalo-pharyngeal sclerites. — These consist of two plates, which are free dorsally, each consisting of three processes: a long, fairly chitinised, anterior, inferior one, a short, fairly heavily chitinised, dorsal one, and a ventral one so lightly chitinised that it is difficult to see how far it extends into the thoracic region".

Larvae II to IV were thus characterized by Townsend (214): "II becomes more or less strongly pyriform, the bare anterior half of the body attenuate, the spined anterior half rounded to ovate; III becomes ovopyriform, only the anal fourth of the body attenuate and the microspines lost; IV becomes long oval with the heavy dorsal spines reduced and stigmata sunk in cavity, each plate with 3 subvertical slits and no button, while the large yellowish flower-like but elliptic anterior spiracles are conspicuous."

The many different descriptions of larvae were assembled by Blanchard (72) and referred to the various larval stages by Townsend (214).

Umaña (128) and Keilin (253) studied the prothoracic spiracle of the larvae. The pupa was briefly characterized by Goudot (31) and a good figure was given by James (266).

6. ANATOMY

Almost nothing is known about the anatomy of *Dermatobia*. Surcouf (122) has a few incidental observations on the anatomy of the transparent stage I.

Some details of the adult are given by Townsend (226): "no salivary glands or crop, ventriculus short and not annulate; duodenum long, stout, coiled, filled with a dark pap. Malpighian ducts very long and tubules longer, colon slender, rectal pouch large, 1 or 2 rectal papillae, postrectum very elongate."

The male genital apparatus was described as being composed by "a testes short oval or obpyriform and with no nipple or vestigial; vasa efferentia slender and scarcely 1/5 longer than testis; vehicular glands club shaped and little longer than testis; vas deferens a little over twice length of vasa and stout on head 1/2 but tapered on rest." (226).

The female genital apparatus was also described by Townsend (214), as follows: "ovaries large, each of 250 to 450 ovarioles, one ovum to each ovariole, not flattened and rolled, but in a solid mass, supplied with numerous tracheae, the tracheal branches penetrating ovaries throughout, with evidently a tracheal termination in each ovariole, but placenta ovarica absent; oviducts very short, 3 small spheric naked free spermathecae, fecundatory glands club shaped and nearly twice length of egg, no uterus, uterovagina short." Still according to Townsend (155) eggs are not incubated, being fecundated while traversing the uterovagina, during oviposition.

7. BIOLOGY

7.1. Habitat

Dermatobia is primarily a forest-inhabiting insect. Open formations and similar habitats prevent its dispertion (111). Townsend says (214) that the fly seeks refuge in the forests against excessive heat and dessication; thus, it is more abundant in the neighbourhood of primeval or second-growth forests, wooded tracts of coastal lowlands, gallery forests, *Eucalyptus* groves (188), etc.

7.2. Mating

Several authors have observed the habit of male Oestridae aggregating in some prominent landmark, almost always on high places, where mating occurs. Consequently, individuals scattered by their hosts can meet and mate more easily. This process must be very effective, if one considers the relatively short life-span of the adult and the widespread distribution of individuals.

Guimarães observed this behaviour among males of *Dermatobia* (375), which were sitting on the trunk of a tree on an isolated knoll. He did not see the copulation, but what is known of oestrid mating leads one to believe that these cuterebrids aggregated for this purpose.

In laboratory conditions, the male can copulate two or more times (109). Copulations lasts from few minutes to a few hours. The mounted female walks for a while, while the male keeps trying to maintain his balance, occasionally flapping the wings. Eventually, the female stops and remains motionless as long as copulation lasts (143).

7.3. Oviposition: origin of intermediate oviposition

Neiva & Florencio Gomes (143) say that when a female is fertilized a little after its emergence, she will lay eggs only after a week; on the other hand, if she is fertilized for the first time in her fifteenth day of life, then oviposition will begin after 48 hours.

Eggs are commonly laid on the body of other insects, notoriously zoophilous flies or mosquitoes, which the female captures with her forelegs. The female only notices moving insects and several attempts can be made until she succeeds in holding one. Once this is accomplished, she takes to the wing with the captured insect, trying at same time to turn up its abdomen. When the ventral surfaces of the abdomens of *Dermatobia* and of the vector come into contact, the former begins to oviposit, starting to lay eggs near the root of the vector's wing (143).

Eggs are always deposited on only one side of the vector, being firmly glued, in variable quantities (373), by an adhesive, quick-drying cement. This cement is very effective. It resists the efforts of the vectors to get rid of the eggs, by scratching the abdomen with their posterior legs (143).

A few moments later, the female is able to catch another insect and oviposit once more. The process can be repeated several times, until she depletes her ovaries, which hold up to 800 eggs (111). Several hundred eggs from a single female can be thus distributed through vectors.

No adequate theory was ever formulated to explain how this puzzling oviposition process has come into existence. The only (and feeble) attempt towards explanation was made by Townsend (214): "*Dermatobia* originally parasitized only the native tropical American mammalian fauna and employed only forest mosquitoes as egg carriers, but with the advent of large cattle herds it found its opportunity to become dominant. This has happened within the past 400 years. *The adoption of bovine cattle as the main host greatly stimulated the development of the carrier host habit, which is still in process of formation* [our italics]. The original thinner skinned hosts, particularly their juvenile stages, did not so strongly call for the egg carrier and it is likely that the fly frequently oviposited directly upon them or in their lairs. This is the more probable since the natural habitat of these hosts is the shade of the forest, where both the fly and egg are protected from beating rains and burning sun. But bovine cattle attracted the fly into bush and more or less open country, which demanded a changed environment for fly and egg, but also to insure penetrating and persisting within the thicker host hides for the maggots."

7.4. Vectors

Bates (247) gave the following common characteristics of vectors of *Dermatobia* eggs: (i) zoophilous habits; (ii) diurnal flying period; (iii) moderate size; (iv) moderately active habits: very sluggish insects would not stimulate the pounding behaviour in *Dermatobia* and very active ones would escape.

Several authors, on different occasions, have published lists of vectors. The most recent one was prepared by Artigas & Guglielmetti Serra (373) and is here adopted (Table I) with some modifications and corrections.

TABLE I

List of vectors of *Dermatobia* eggs

(Numbers correspond to our bibliographical references)

Family Culicidae

1. *Aedes* (*Finlaya*) *leucocaelenus* Dyar & Shannon, 1924 — 216 (Brasil).
2. *Aedes* (*Ochlerotatus*) *angustivittatus* Dyar & Knab, 1907 — 262 (Costa Rica).
3. *Aedes* (*Ochlerotatus*) *serratus* (Theobald, 1901) — 247 (Colombia), 262 (Costa Rica).
4. *Aedes* (*Ochlerotatus*) *taeniorhynchus* (Wiedemann, 1821) — 267 (French Guiana), 312 (French Guiana).

5. *Anopheles* (*Arribalzagaia*) *intermedius* (Chagas, 1908) — 373 (Brasil).
6. *Anopheles* (*Kerteszia*) *boliviensis* (Theobald, 1905) — 247 (Colombia).
7. *Anopheles* (*Nyssorhynchus*) *rangeli* Gabaldon, Cova-Garcia & Lopes, 1940 — — 247 (Colombia).
8. *Culex* sp. (?) — 114 (Guatemala).
9. *Hemagogus capricornii* Lutz, 1904 — 247 (Colombia).
10. *Mansonia* spp. — 247 (Colombia).
11. *Mansonia* (*Mansonia*) *titillans* (Walker, 1948) — 254 (French Guiana), 312 (French Guiana).
12. *Mansonia* (*Rhynchotaenia*) *fasciolata* (Arribálzaga, 1891) — 311 (French Guiana), 312 (French Guiana).
13. *Psorophora* sp. — 118 (Mexico).
14. *Psorophora* (*Grabhamia*) *cingulata* (Fabricius, 1805) — 247 (Colombia).
15. *Psorophora* (*Janthinosoma*) *albipes* (Theobald, 1907) — 225 (Brasil).
16. *Psorophora* (*Janthinosoma*) *cyanescens* (Coquillett, 1902) — 169 (Venezuela).
17. *Psorophora* (*Janthinosoma*) *ferox* (Humboldt, 1820) — 143 (Brasil), 163 (Brasil), 216 (Brasil), 254 (French Guiana).
18. *Psorophora* (*Janthinosoma*) *lutzi* (Theobald, 1901) — 123 (Trinidad), 148 (Brasil), 173 (Panama), 174 (Central America), 254 (French Guiana), 312 (French Guiana).
19. *Psorophora* (*Janthinosoma*) sp. — 116 (Venezuela), 118 (Mexico), 122 (Venezuela).
20. *Trichoprosopon* (*Rhynchomyia*) *lampropus* (Howard, Dyar & Knab, 1915) — 247 (Colombia).
21. *Trichoprosopon* (*Rhynchomyia*) *longipes* (Fabricius, 1805) — 173 (Panama).
22. *Wyeomyia* spp. — 247 (Colombia).
23. *Wyeomyia* (*Davismyia*) *petrocchiae* (Shannon & Del Ponte, 1927) — 216 (Brasil).
24. *Wyeomyia* (*Dendromyia*) *confusa* (Lutz, 1905) — 374 (Brasil).

Family Simuliidae

25. *Simulium* sp. — 97.
26. *Simulium pruinosum* Lutz, 1910 — 352 (Brasil).

Family Tabanidae

27. *Chrysops* sp. — 225 (Brasil).

Family Anthomyiidae

28. *Fannia heydenii* (Wiedemann, 1830) — 130 (Brasil), 148 (Brasil).
29. *Fannia pennicillaris* (Stein, 1900) — 374 (Brasil).
30. *Fannia petrocchiae* (Shannon & Del Ponte, 1926) — 374 (Brasil).
31. *Fannia scalaris* (Fabricius, 1794) — 374 (Brasil).
32. *Fannia* sp. — 374 (Brasil).
33. *Hylemyia lindigii* (Schiner, 1868) — 148 (Brasil).
34. *Limnophora* sp. — 313 (Costa Rica).

Family Muscidae

35. *Morellia humeralis* (Stein, 1918) — 374 (Brasil)
36. *Morellia* sp. — 374 (Brasil).
37. *Musca domestica* (Linnaeus, 1758) — 161 (Brasil), 313 (Costa Rica), 332 (Costa Rica).
38. *Neivamyia lutzi* Pinto & Fonseca, 1930 — 196 (Brasil).
39. *Pselaphephila* sp. (?) — 197 (Brasil).
40. *Sarcopromusca arcuata* (Townsend, 1927) — 313 (Costa Rica).
41. *Sarcopromusca pruna* (Shannon & Del Ponte, 1927) — 374 (Brasil).
42. *Stomoxys calcitrans* (Linnaeus, 1758) — 313 (Costa Rica), 332 (Costa Rica).
43. *Synthesiomyia nudiseta* (Wulp, 1833) — 143 (Brasil), 241 (Brasil).

Family Sarcophagidae

44. *Hybopygia terminalis* (Wiedemann, 1830) — 197 (Brasil).

Family Calliphoridae

45. *Cochliomyia macellaria* (Fabricius, 1749) — 206 (Brasil).
46. *Cochliomyia* sp. — 313 (Costa Rica).
47. *Cryptolucilia* sp. — 320 (Colombia).

Family Cuterebridae

48. *Dermatobia hominis* (Linnaeus Jr., 1781) — 322 (Costa Rica, in laboratory conditions).

Acari, family Ixodidae

49. *Amblyomma cajennense* (Fabricius, 1787) — 147.

7.5. Penetration into the host

Eggs of *Dermatobia* are attached to carriers by their caudal end, being obliquely bent downwards, so that their cephalic end will come immediately into contact with the host's skin, when the vector alights on it.

Before the introduction of cattle and other domestic animals in the Americas, during the XVI century, *Dermatobia* parasitized the native mammalian or avian fauna, especially monkeys, hogs, jaguars, pumas, agoutis, grisons, armadillos, etc.; among the birds, toucans and ant-birds. The heavy infestation of domestic animals that now prevails is a secondary adaptation.

Even before the emergence of the larva, the operculum of the egg can be seen into the shape of a fingernail, and when opened, remains attached to the chorion, by what could be compared to the nail's root.

When the eggs come into contact with the skin, the operculum opens and the larva projects a part of its body from the egg, moving quite actively. If it does not succeed in reaching the skin or a hair of the host, it will withdraw into the egg shell and the operculum closes again.

This effect can be experimentally induced, approaching and removing the eggs from the skin (143).

Larvae take about one week to eclode and can remain alive within the eggs for approximately 20 (171) to 28 days. They can penetrate the skin at the spot they first touch it, or crawl for some distance and then burrow. They enter through any place, including hair follicles. There is no special region for the development of the larvae. In man, the uncovered parts are most affected. They can locate also in the eye, the nostrils, etc. In animals, notably cattle, the dorsal, neck and tail regions, which are less accessible to the tongue, are most seriously affected (133).

Penetration can take from 5 to 10 minutes (143). The larvae penetrate until they arrive to the subcutaneous tissues, where they stay in an almost horizontal position, with the posterior stigmata turned to the outside. The penetration site of the larva develops into a "boil-like tumour", open to the outside, thus permitting the respiration of the larva. James (266) classifies this form of myiasis as "furuncular dermal" or "subdermal".

Even a few hours after penetration, the larva can still be seen through the skin, especially its circlets of black spines in the anterior portion.

7.6. Larval period

No exact records on the length of each separate larval instar exists. From data obtained by Dunn (193), the following estimates can be made: from penetration to first molting — 12 days; from first to second molting — 18 days; from second molting to emergence from the host — 18 days; total — 46-47 days. The larval period takes a variable amount of days (143); those disparities in time span were attributed to differences in temperature.

The larvae seem to eat the purulent and necrotic materials of the wound. Filtrates from crushed intestines of the larvae revealed bactericidal action on *Staphylococcus* from man and cattle (211). The respiratory mechanisms of the larvae have been studied by Keilin (253).

7.7. Pupation and emergence of adults

The mature larva abandons the host and falls to the ground. If the soil is loose and damp, penetration undergoes easily — 10-15 minutes (109) and more than 2 hours if it is more compact. If the larvae do not succeed in penetrating the soil, they will pupate above it, but adults will not emerge (111). The transformation of the mature larva in pupa takes about 48 hours, in experimental conditions (143).

Experiments on pupation were made, under several conditions (313, 332). Zeledón (332) demonstrated that in experiments on pupation in which various materials were used as substrate, there were "no

appreciable differences in the larvae's ability to pupate and their viability in the various media. The substrate seems to act simply as an absorbent of the excess of liquid which the larva must eliminate as the construction of its pupary [sic] is begun. If the process is not carried out under such conditions, pupation in general is imperfect, as was shown when mature larvae were placed in a flask without any absorbent material of any kind."

An interesting observation on the mature larvae was made by Neiva & Florencio Gomes (143) : those with less than 0.6 g will give males, and those with more than 0.6 g, females.

The depth attained by the mature larva burrowing in the soil, before pupating, is in direct dependance of the physical conditions of the soil, but more particularly of the soil temperature. When a pupa is exposed to the sun, it will not develop (111).

The pupal period lasts from 34 to 78 days, in laboratory conditions. The puparium opens by an operculum situated laterally in the anterior end, and the adult generally emerges during the hottest hours of the day (143).

8. PATHOGENESIS AND ECONOMIC IMPORTANCE

In man, the parasitic larvae can cause dermal myiases (3, 4, 5, 6, 7, 8, 9, 11, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 30, 35, 37, 38, 39, 42, 43, 44, 49, 53, 54, 56, 58, 59, 60, 61, 62, 63, 64, 66, 68, 69, 70, 71, 72, 74, 76, 79, 80, 87, 92, 102, 105, 108, 110, 114, 115, 127, 129, 133, 138, 139, 151, 152, 153, 176, 178, 188, 190, 193, 198, 199, 208, 219, 211, 228, 256, 257, 262, 268, 279, 288, 307, 316, 325, 336, 346), palpebral myiasis and ophthalmomyiases (103, 158, 170, 173, 179, 180, 181, 182, 184, 185, 186, 187, 191, 221, 230, 231, 255, 289), rhinomyiases (187, 207), cerebral myiasis (208) and inclusive iliac tumours (282).

Several animals are also attacked, as cattle, jaguars, agoutis, pigs, cats, dogs, monkeys, pumas, donkeys, mules, horses, sheeps, rabbits, armadillos, toucans and ant-birds (3, 4, 5, 31, 34, 49, 50, 53, 54, 56, 57, 89, 120, 127, 133, 138, 172, 173, 175, 176, 178, 188, 190, 208, 209, 222, 237, 254, 256, 257, 298, 318, 367).

The wounds become infected, and purulent, due to secondary infections, causing severe pains. Frequently these lesions can be complicated by attacks of other species of flies, especially *Cochliomyia hominivorax* and *Cochliomyia macellaria* (Calliphoridae) (138, 153). Young animals are more attacked and can perish when heavily infested.

Milk and meat production is reduced, and hides become damaged. All these effects are of great economic importance (57, 112, 208, 237, 250, 298, 323, 329, 361, 370). It is estimated that an annual loss of US$ 200,000,000 in meat, milk and hides is produced by *Dermatobia*. Mullison & Shaver (361) furnish the following estimates of losses in Central America: meat — US$ 3,250,000; milk — US$ 450,000 and hides — US$ 1,000,000 per year.

TABLE II

Organophosphorous systemic insecticides used against *Dermatobia* larvae

Common name	*Other usual names*	*Chemical composition*	*References*
DDVP	Dichlorvos	O-O-dimethyl-2-2-dichlorovinyl-phosphate	369
Ronnel *	Trolene, Dow ET-57, Nankor *, Korlan *, Etrolene, Ectoral, Fenchlorphos	O-O-dimethyl-O-2-4-5-trichlorophenyl phosphorothioate	335, 350, 351
Trichlorphon	Dipterex *. Dylox *, Dyrex, Chlorophos, Bayer L 13/59, Neguvon, Dyvon	O-O-dimethyl-2-2-2-trichloro-1-hydroxyethyl phosphonate	342, 348, 356, 358, 344, 366, 369, 370
Ruelene *	Chloromidate, Montrel, Hypolin	4-tertiary-2-chlorophenyl-methyl-phosphoroamidate	361, 369
Coumaphos	Co-Ral *, Assuntol, Bayer 21/199	O-O-diethyl-O-chloro-4-methyl-2-oxo-2h-1-benzopyran-7-yl-phosphorothioate	199, 304, 342 349, 366, 370
Dimethoate *		O-O-dimethyl-S-(N-methylcarbamoylmethyl) phosphorodithioate	358, 359, 364
Dowco-109	Narlene	O-(4-test-butyl-2-chlorophenyl)-O-methyl-methylphosphoroamithioate	333, 341, 343 345, 362, 365

* Names registered in the U. S. Department of Agriculture (from *Summary of registered agricultural pesticides chemical uses*, 2nd ed., 1964).

9. TREATMENT AND CONTROL

Several methods were devised for the extraction of *Dermatobia* larvae in man — tobacco (5, 14, 17), a mixture of tobacco, aloes, asafetida and vinegar (260), cigars' ashes (17, 58), pork fat (79), chloroform (54, 92), ethyl chloride (221), amonia (54), a "chicle" made with the gum of *Achras sapota* (105), etc. All these methods serve to obstruct the orifice of the wound (where the posterior spiracles of the larva are, thus preventing its respiration), to anesthetize or kill the larva.

Once the larva is dead, it is squeezed out with the thumb and the forefinger of both hands, with relative ease, especially when mature. Otherwise, the larva can be extracted with needles (3), or with the help of some other instrument (19, 127, 244, 316). For more dangerous locations, especially in the case of ophthalmomyiases, surgical techniques have been devised (181, 182, 230, 231, 255, 289).

For domestic animals, the same primitive methods used for men still give good results, when infestation is low and in a few animals only. For larger herds, as obvious, other methods are to be employed.

Before the advent of modern insecticides, several methods were employed to control this parasite of domestic animals: onion (248, 249), creolin (133, 138, 260), Lindane (324), BHC (269, 280, 281, 284, 290, 305, 315, 350), Toxaphene (269, 284, 291, 304, 305, 315, 340, 365), DDT (259, 269, 305, 315), Chlordane (280, 315), Aldrin (305, 315), cubé powder (active principle — rotenone) (269), Fenatox (290), Londagan and Esso "A" (294), Smear EQ 235 (293), etc. These chlorinated hydrocarbon insecticides were tested as dips, sprays, ointments, etc.

The organophosphorous systemic insecticides are presently the most efficient. Table II shows the several products employed, their different names, chemical composition and references about their use.

Among other measures to control this pest (141, 160, 161, 162, 178, 213, 224, 245, 264, 270, 271, 273, 278, 283, 286, 292, 296, 297, 299, 300, 301, 302, 308, 310, 319, 327, 328, 330, 337, 353, 354, 357), are to be cited the plantation of *Melinis minutiflora* (Gramineae) (165) and breeding of resistant races of cattle (363).

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In this book is to be found the first supposed reference to *Dermatobia*, referred to as "gusanos" which constituted a calamity to the first Spanish conquistadores which travelled through the Madalena River, and those which entered with the "Adelantado" Ximenez de Quezada in the plains east of the Andes, in 1569.

2. Montoya, A. R. de, S. J., 1629: *Tesoro de la lengva gvarani. Compuesto por el Padre Antonio Ruiz, de la Compañia de Iesvs. Dedicado a la Soberana Virgen Maria, concebida sin mancha de pecado original*, 14 + 408 pp., Iuan Sanchez, Madrid.

"*Ura* — gusano que se cria en carnes". Montoya is the first author, as it seems, to cite the guarani word for *Dermatobia* larvae.

3. Cobó, B., S. J., 1653: *Historia del Nuevo Mundo.* (Edited in 1890, by M. Jimenez de la Espada — Tomo I de la Sociedad de Bibliófilos Andaluces; Vol. *1* (1890): VIII + 538 pp.; vol. *2* (1891) : 467 pp.; vol. *3* (1892): 350 pp.; vol. *4* (1895): 247 pp.; Imp. de E. Rasa, Sevilla).

Blanchard (89) translated the following extract from this book : "Tome II, page 254 — 'Dans certaines terres *yuncas* se trouve une espèce de *Mosquitos* qui sont sans doute les plus nuisibles; ils ressemblent aux *Zancudos* et leur couleur tire sur le rouge. Dans chaque piqûre de ces Mosquitos il y croît bientôt, au-dedans de la chair, un ver velu de la taille d'un Haricot et même plus grand, qu'il faut extraire avec une épingle de la même manière que les *Niguas*. Un homme digne de foi m'a conté qu'un chien s'étant perdu dans un bois ou fourré de la Province d'Alvarado (Nouvelle-Espagne), il en sortit au bout de trois jours et revint si plein de Vers résultant des piqûres de ces Mosquitos que, d'accord avec ses compagnons, il préfera le laisser mourir, car ils étaient en nombre infini; et, en effet, le Chien mourut promptement, tourmenté par ces vers."

4. La Condamine, C. M. de, 1745: *Rélation abrégée d'un voyage fait dans l'intérieur de l'Amérique Meridionale, depuis de la côte de la Mer du Sud, jusqu'aux côtes du Brésil & de la Guiane, en descendant la Rivière des Amazones.* Veuve Pissot, Paris.

Page 166 : "Le ver appellé chez les Maynas *Suglacuru* et à Cayenne *ver Macaque* prend son accroissement dans la chair des animaux et des hommes; il y croît jusqu'à la grosseur d'une fève, et cause une douleur insupportable; il est assez rare. J'ai dessiné à Cayenne l'unique que j'ai vû, et j'ai conservé le ver même dans l'esprit de vin; on dit qu'il nait dans la plaie faite par la piqûre d'une sorte de Moustique ou de Maringouin, mais jusqu'ici l'animal qui dépose l'oeuf, n'est pas encore connu."

5. Arture, (—), 1753: Observations sur l'espèce de ver nommé Macaque. *Mém. Acad. Royale Sci. Paris* (1752): 72-73.

"Cet insecte est du genre de ceux qui se trouvent sous la peau des animaux, et qui y vivent jusqu'à leur transformation en mouches, de la sanie et du pus qu'ils y occasionnent. On en voit assez fréquemment sur l'espèce de singe que est la plus commune en France, et c'est probablement de cet animal, que se nomme en langue du pays, Macaque, que le ver a pris son nom. On en rencontre aussi sur les chevaux, sur les chiens, sur les chats, sur les oiseaux, et même sur les hommes; mais on n'en trouve guère que sur des Nègres, des soldats, ou sur quelques autres personnes mal-propres on peu vêtues : il ne s'en voit jamais que sur les parties découvertes; celles qui les habits couvrent, en sont toujours exemptes. Il y a toute apparence que la mouche qui produit le ver, vient pondre son oeuf sous la peau de l'animal au moyen de quelque terrière qui lui sert à la percer et à conduire son oeuf, et qu'elle prend le temps où elle le trouve endormi. L'insecte éclos ocasionne une tumeur assez considérable, qui s'enflamme et donne la fièvre : on peut hâter la maturité de cette tumeur par les remèdes ordinaires; alors elle s'ouvre d'elle même, et le ver s'y fait apercevoir par ses mouvements; mais il est souvent très-difficile de l'en tirer, quoiqu'il tienne à rien; et pour épargner des douleurs au malade,

on se contente d'appliquer sur la tumeur ouverte des feuilles de tabac ou de chou caraïbe, qui font périr le ver en peu de jours; alors il sort avec la matière, et la plaie guérit assez promptement."

6. Juzarte, T. J., 1769-1770: *Diario da navegação do Rio Tieté, Rio Grande Paraná, e Rio e Gatemy em que se dá Rellação de todas as cousas mais notaveis destes Rios, seu curso, sua distancia, e de todos os mais Rios que se encontrão, Ilhas perigos, e de todo o acontecido neste Diario, pelo tempo de dous annos e dous mezes. Que principia em 10 de Março de 1769.* (Edited by A. d'Escragnole Taunay, 1922: *Ann. Museu Paulista 1* (2): 31-118).

Page 47 : "Os inceptos q̃ perseguem são mosquitos chamados polvora, borrachudos; pernilongos, e em tanta quantidade q̃ se formão nuvens; alem destes há os vermes q̃ picando na cutes introduzem dentro hũ bicho negro gadelhudo a similhança de hũa lagarta de coube."

7. Gilij, P. S., S. J., 1780-1784: *Saggio di Storia Americana, o sia Storia Naturale, Civile E Sacra de' regni, e delle provincie Spagnuole di Terraferma, nell'America meridionale, descrita dall'Abate Filipo Salvatore Gilij, e consecrata alla Santità del N. S. Papa Pio Sesto felicemente regnante,* Luigi Perego Erede Salvioni, Roma.

Tomo I (1780): *Della storia geografica, e naturale della provincia dell'Orinoco.*

Tomo II (1781): *Costumi degli Orinochesi.*

Tomo III (1782): *Religione, e delle lingue degli Orinochesi, e di altri americani.*

Tomo IV (1748): *Stato presente di Terraferma.*

Gilij was an Italian missionary who spent eighteen years among the missions in several countries of South America, especially those along the Orinoco. Having returned to Italy, after the expulsion of the jesuits from the Spanish possessions in America, he wrote is "Saggio", where can be found a reference to the "gusano peludo" which feeds upon the human flesh. Gilij saw one of these "gusanos" in the back of one of his friends, in Santa Fe, Bolivia.

8. Linnaeus Jr., C. von, 1780: [Letter do Dru Drury, dated from March the 10th 1780] *in* Drury, D., 1837: *Illustrations of exotic entomology, containing upwards of six hundred and fifty figures and descriptions of foreign insects 1*: 126 pp., London.

Page xi : "Nuper litteras habui ex America Meridionali ubi morbus endemius est hominum etiam Europeos aggredit illuc venientes quae causatur a larva Œstri, quae intra cutem per integrum annum coelatus et nullo remedio expelli potest nisi periculo vitae; est nova species Œstri."

9. Linnaeus Jr., C. *in* Pallas, 1781: [Mittheilungen über *Oestrus hominis*]. Pallas' *Neue nordische Beytr. Phys. Geogr. Erd. u. Völk. 1:* 157-158.

In this letter addressed to and published by Pallas, Linnaeus Jr. gives the name *Oestrus hominis* to the larva which lived under the human skin, according to informations he had received from South America. Following Keferstein (36): "Er hoffe den *Oestrus hominis*, der in Peru den Menschen angreife, zu erhalten. Die Fliege, fährt er fort, legt ihre Eier oder vielmehr lebendige Maden, deren sie bis 50 im Hinterleib herumträgt, eine nach der andern auf die Haut des Menschen. Der Wurm bohrt sich sogleich ein und wächst ½ Jahr. Legt man Mittel auf die Wunde, so bohrt er sich noch tiefer ein und das Geschwür wird schlimmer. Lässt man die Larve in Ruhe, so kommt sie gegen die Verwandlungszeit hervor und wird zu einer schwärzlichen Fliege, *Oestrus hominis.*"

10. Modeer, A., 1786: Styng-flug slägtet (*Oestrus trompe, tarandi, haemorrhoidalis, nasalis, bovis, ovis, elaphi, antilopum, fasciculosus, hominis*). *K. Vetensk. Acad. Nya Handl.* [Ser. 2], *7*: 125-158, 180-185.

Not seen.

11. Gmelin, J. F., 1788: *Caroli à Linné Systema Naturae, per regnum triae Naturae, secundum Classes, Ordines, Genera, Species, cum characteribus, et differentiis. Ed. XIII 1* (5): 2225-3020, Laur. Salvii, Holmiae.

Page 2811 : *"Oestrus hominis* — totus fuscus. Habitat larva in America australis per sex menses sub cute hominum abdominali, si turbetur, profundius penetrando periculosa, adeo ut fertur, lethalis; imago muscae domesticae magnitudinis."

12. Anon., 1795: *Diccionario portuguez e brasiliano.* Officina Patriarchal, Lisboa. (Reprinted by P. M. da Silva Ayrosa, 1934: *Rev. Museu Paulista 18*: 19-319).

Cites the guarani word "ura" ou "urã", applied to *Dermatobia* larvae.

13. Humboldt, A. von, 1807: *Voyage de Humboldt et Bompland, Première partie : Physique générale et rélation historique du voyage.* Paris.

Page 136: "...au Mosquitos se joigne l'*Oestrus hominis*, qui dépose ses oeufs dans la peau de l'homme, et y cause des enflures considérables..."

14. Azara, F. de, 1809: *Voyages dans l'Amérique Méridionale 1*: LX + 389 pp., Dentu, Imprimeur-Libraire, Paris.

Page 217 : "Les papillons sont très-multipliés, très beaux, de petite et de moyenne taille; il y en a de nuit et de jour. Quelques-uns de ceux-là qui sont très petits entourent la lumière en si grand nombre, qu'ils l'interceptent. Une autre espèce, grande et brunâtre, dépose ses vers enveloppés d'une sorte de bave, sur la chair des personnes qui dorment toutes nues ou sans couverture, et les petits vers s'introduisent sous la peau, sans qu'on le sente. Il en résulte un petit bouton qui démange; la partie s'enfle, et l'on éprouve une douleur assez vive. Les habitans de la campagne voient à l'instant ce que c'est: ils mâchent du tabac et crachent sur la piqûre : ils la present ensuite fortement avec les doigts et il en sort cinq à six vers velus, d'une couleur obscure, longs d'environ un demi-pouce, sans que cela produise aucune mauvaise suite."

15. Olivier, A. G., 1811: *Encyclopédie Méthodique. Dictionnaire des Insectes 8* (MOU-PAO): 722 pp., Pankouke, Paris.

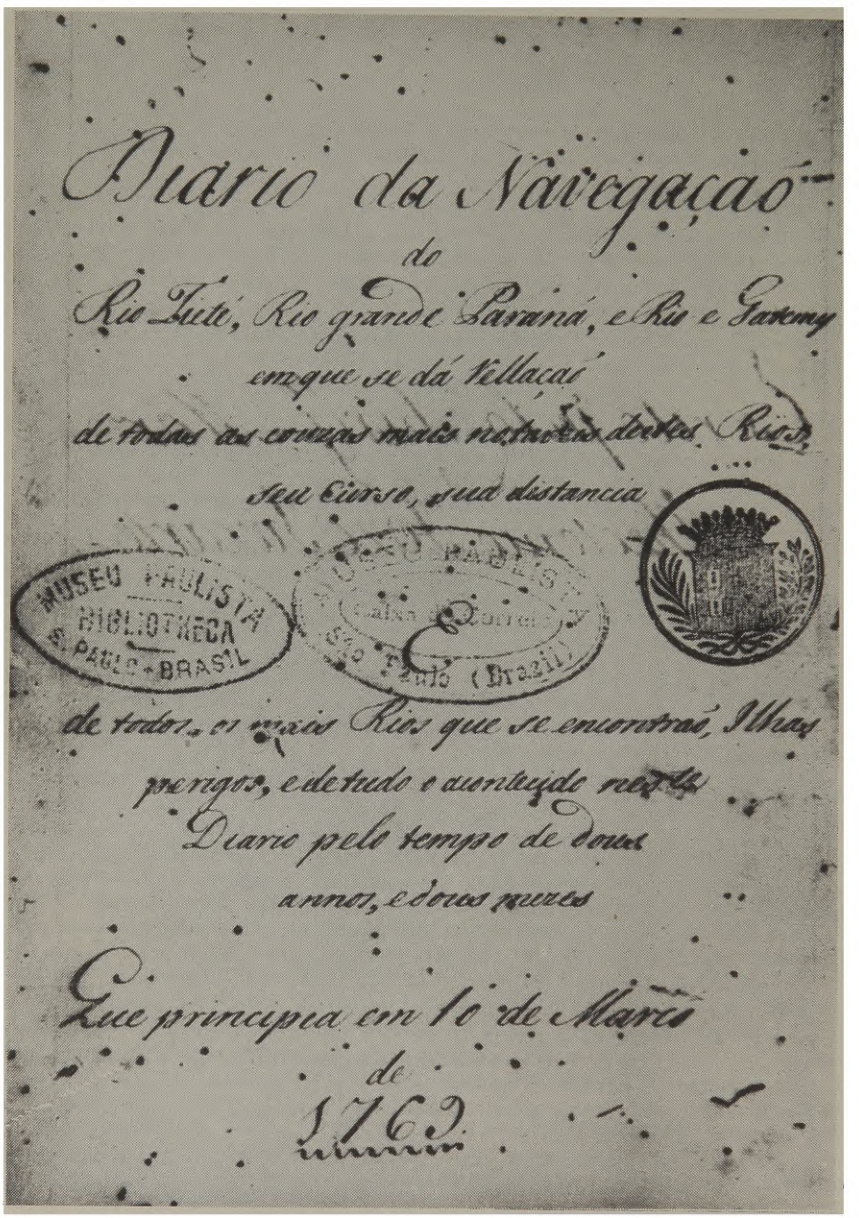
Olivier merely translates into French the comments of Gmelin (11), at the page 467 of the dictionary.

16. Wied-Neuwied, Maximilian, Prinz zu, 1820: *Reise nach Brasilien in den Jahren 1815-1817 1* : 380 pp., illus., H. L. Brömer, Frankfurt a. M.

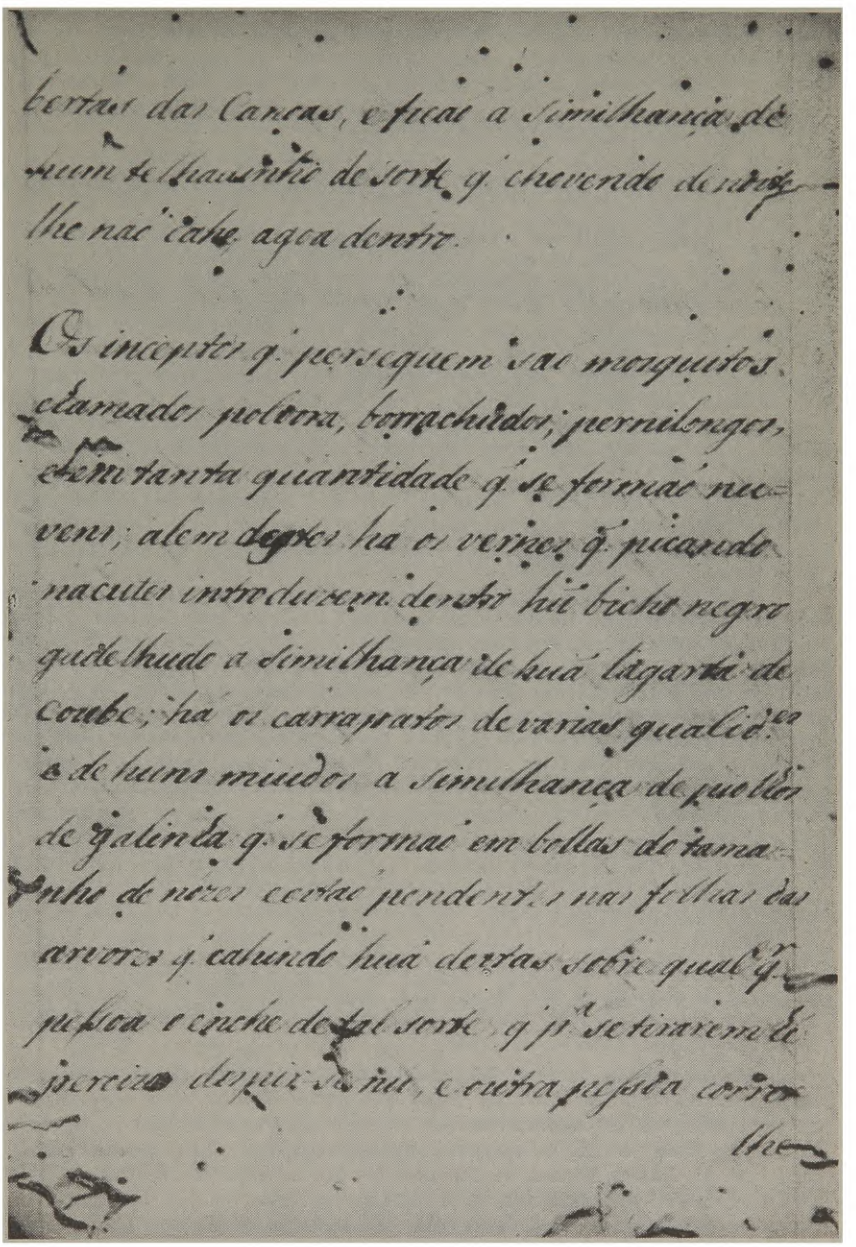
Page 191 : "Es giebt in Brasilien noch ein anderes Insekt, das sein Ey in das Muskelfleich oder unter die Haut, selbst des Menschen legt; nach dem Stich dieses Thieres spürt man einen kleinen örtlichen Schmerz, die Stelle schwillt bis zu einer gewissen Höhe an, alsdann zogen unsere Leute, die dieses beschwerliche Uebel recht gut kannten, eine Made, einen kleinen weissen, länglichten Wurm hervor, worauf die gemachte kleine Wunde sogleich heilte. Azara spricht wahrscheinlich von demselben Insekte, er glaubt indessen, dass erst der Wurm selbst in die Haut eindringe, welches mit unsern Erfahrungen nicht übereinstimmt."

17. Say, T., 1822: On a South American species of *Oestrus* which inhabits the human body. *J. Acad. Sci. Philad. 2* (2): 353-360. (Also published in French, 1822: Sur une espèce d'Oestre de l'Amerique Méridionale que habite le corps humain. *Bull. Univ. Sci.* 3: 264, and in German, 1824: Über eine in menschlichen Körper lebende südamerikanische Species von *Oestrus. Frorieps Notizen 6* (122): 177-180).

Describes a larva received from one of his friends who had been travelling in Maracaibo. The larva was extracted from the latter with tobacco and cigar's ashes. In a letter sent to Say it was reported that "Ouche" is the name it was called by some people in Maracaibo, who said that the disease was produced by a worm wich crawled onto the body of the host from the ground. Others maintained that they were produced by the sting of a winged insect called Zancudo, and others called the larva Husano (...).



Title-page of Juzarte's manuscript (1769), the first reference to *Dermatobia* in Brazil (Courtesy of Dr. Mário Neme, Museu Paulista, Universidade de São Paulo).



Page of Juzarte's manuscript describing the larva of *Dermatobia* (see reference 6) (Courtesy of Dr. Mário Neme, Museu Paulista, Universidade de São Paulo).

18. Hill, N. T., 1830: Account of the larva of a supposed *Oestrus hominis*, or gad-fly, which deposits its eggs on the bodies of the human species, with the particulars of a case. *Edinburgh New Philos. J. 22*: 284-288, 1 fig. (Also published in *London's Magaz. Nat. Hist. 5* : 483).

Report of a case of myiasis produced by *Dermatobia*. The larva was located in the arm of a sailor who came from Georgetown, British Guiana.

19. Roulin, F. D., 1833: [Larves d'Oestres chez l'homme]. *L'Institut 1* (4): 25. (Also published in *Isis 4:* 309, 1837).

We have not seen Roulin's original paper, but only the citation given by Blanchard (73), here transcribed. The observations were made at Mariquita, Colombia.

"Un homme avait au scrotum une tumeur conique, dont le diamètre, à la base, était de près de deux pouces, et dont la hauteur était à huit lignes. Le sommet, très rouge, présentait au milieu une petite ouverture dont la largueur n'était guère d'une ligne. Ayant grandi cette ouverture avec la pointe d'une lancette, en fit sortir une larve blanchâtre, pyriforme, ayant au moins dix lignes de long et cinq à six de diamètre dans la partie plus grosse, où elle offrait plusieurs rangées de petites épines noirâtres."

Roulin adds some observations on the finding of a larva in the man's scalp and another beneath the skin of a puma. The author says that those larvae were not different from the ones usually found in cattle, in the same locality.

20. Saint Hilaire, G., 1833: Rapport fait à l'Académie des Sciences, le 15 juillet 1833, sur trois notices relatives à l'existence de l'Oestre de l'homme, communiquées à l'Académie par MM. Roulin, Guérin et Vallot. *Ann. Soc. Ent. France 2*: 518-527.

After general considerations on the subject, Saint Hilaire comments the reports presented by Roulin, Guérin and Vallot on the existence of a larva causing dermal myiasis in man, and concludes : "ces divers cas (...) forment un tel ensemble de faits parfeitement concordans entre eux, ils se servent si bien mutuellement de preuves et de garantie, qu'on ne peut vraiment, sans outer le scepticisme, se refuser à admettre l'éxistence des larves d'Oestre qui, vivent en parasites sous la peau de l'homme, causant par leur présence de vives douleurs, et leur extraction étant toujours facile, il sera pour le moins très rare de voir ces insectes parvenir jusqu'au moment de leur métamorphose."

21. Roulin, F. D., (—) Guérin & J. M. Vallot, 1833: Extrait d'un rapport sur la découverte de larves d'Oestres chez l'homme... : fait par M. Isidore Geoffroy Saint Hilaire à l'Académie des Sciences de Paris, le 15 juillet 1833. *L'Institut* (10) *1:* 85.

Not seen.

22. Howship, J., 1833: An account of two cases of inflammatory tumour produced by a deposit of the larva of a large Fly (*Oestrus humanus*) beneath the cutis in the human subject; accompanied with drawings of the larva. *Proc. Royal Soc. London 12*: 181.

This is only a brief reference to a paper read at a meeting of the Royal Society : "The first of these two cases is that of a soldier stationed on the banks of the Marawina River in Surinam, who had a large boil on the back, from which a maggot was pressed out. The second case, which occurred at Santa Maria, in the district of Maraquita, in Colombia, is that of a carpenter, who had for some months a large boil on the scrotum, from which a living larva was extracted. A description of the larva, drawn up by Mr. Curtis, is given by the author, together with a drawing of the specimen. The author proposes giving to it the name of *Oestrus humanus.*"

The species was described and figured by Howship and Curtis, respectively, and the work was printed in 1834 (see next reference).

23. Howship, J., 1834: Some account of two cases of inflammatory tumour, produced by the deposit of the larva of a large fly (*Oestrus humanus*) beneath the cutis in the human subject, accompanied with drawings of the larva. *Med. Quart. Rev.* (1834): 174, 1 pl.

Howship describes the larva as *Oestrus humanus*. The description is accompanied with three figures, representing the larva in lateral and ventral views, and a detail of the cephalic end.

24. Poeppig, E., 1835: *Reise in Chile, Perú und auf dem Amazonenstrom*, 2 vols. and Atlas, Leipzig.

Poeppig believed that horseflies were responsible for the transmission of the larva which caused dermal myiasis. Poeppig's observations were made in the Maynas Province, from where was reported the existence of the "suglacuru" by La Condamine (4).

25. Rengger, A., 1835: *Reise nach Paraguay in den Jahren 1818 bis 1826 von J. R. Rengger. Aus des verfassers hanschriftlichen Nachlasse herausgeben von A. Rengger*, Aarau.

Rengger reports a case of myiasis due to *Dermatobia* seen in Asunción, Paraguay. He cured the wound with corrosive sublimate.

26. Guyon, M., 1836: Mémoire pour servir à l'histoire naturelle et médicale du ver Macaque, écrit à la Martinique en 1823. *Bull. Soc. Sci. Arts & Lettres Depurt. Var 3* (2-4).

Not seen. This reference was cited only by Coquerell & Sallé (38) and deals with three observations, one made at the river Manas, French Guiana and two at Trinidad.

27. Keferstein, G. A., 1837: *Naturgeschichte der schädlichen Insecten nach eigenen und fremden Beobachtungen. I. Die den Menschen und den Thieren schädlichen Insecten*, 8 + 346 pp., Keyser, Erfurt.

Not seen. Cited by Keferstein (36).

28. Hope, F. W., 1840: On insects and their larvae occasionally found in the human body. *Trans. Ent. Soc. London* 2: 256-271, pl. 22, figs. 1-5.

After general considerations on the subject, Hope gives a table with citations of all previous papers on dermal myiasis, including those caused by *Dermatobia*. See chapter 4 for a discussion of *Oestrus guildingii*.

29. Macquart, M. J., 1843: *Diptères exotiques, nouveaux ou peu connus 2* (2): 309 pp., 36 pls., Roret, Paris.

Macquart was the first to describe the adult fly, under the name *Cuterebra cyaniventris* (p. 23). Here follows his description:

"Cyaneus. Antennis flavis. Pedibus rufis.

Long. 5½ l. ♀. Face jaune. Front noir, à duvet grisâtre et base testacée. Antennes jaunes; troisième article quatre fois aussi long que le deuxième; style ne paraissant cilié qu'en dessus. Thorax d'un noir bleuâtre, à léger duvet gris et poils noirs serrés. Abdomen deprimé, d'un beau bleu métalique, un peu violet. Pieds d'un fauve clair. Cuillerons et ailes un peu brunâtres.

Du Brésil. Muséum."

The name proposed by Macquart is also a synonym. Macquart was very reluctant to admit the existence of a human Oestrid : "les autres (larves) ont été observées sur les hommes de l'Amérique Méridionale, mais jusqu'à present, ces observations sont trop incomplètes pour admettre l'existence d'un Oestre chez l'homme."

30. Penniston, T., 1844: A case of *malis oestri* or gadfly bite, occurring in the human subject. *New Orleans Med. Surg. J. 1* (2): 24-27, 1 pl.

Blanchard (73) gives the following abstract of Penniston's paper : "Un mousse âgé de seize ans, après avoir sejourné quelque temps sur la côte de l'État de Tabasco (Mexique), sentit tout à coup dans le bras gauche une démangeaison accompagnée d'une sensation de piqûre ou de morsure, et reconnut en ce point une petite tumeur percée, à son centre, d'un trou de la grandeur d'une tête d'épingle, d'où suintait une matière claire et jaunâtre.

...en la comprimant (la tumeur), on en fait sortir une larve longue de 10 lignes (21 mill.), large de 4 lignes (8 millim. 45) dans sa partie la plus épaisse et d'une ligne et quart (2 mill. 6) aux deux extremités. La tumeur présente alors l'aspect d'un furoncle, après la sortie du bourbillon. Au bout de quatre jours, l'inflammation était dissipée et la guérison complète."

Follows a description of the larva. Penniston remarks that the larva belonged to the Oestridae, and gives some figures of it.

31. Goudot, J., 1845 : Observations sur un Diptère exotique dont la larve nuit aux boeufs (Le Cuterèbre nuisible). *Ann. Sci. Nat.* (3) *3* : 221-230, pl. 4 bis, figs. 1-6. (First appeared in *Bull. Soc. Ent. France* (1844) : 41).

"CUTEREBRA NOXIALIS. Cuterèbre nuisible, Goudot.

C. abdomine cyaneo, basi pilis albidis.

Longueur 1 centim. 7 millim. (7 à 8 lignes); antennes jaunes, le premier article ayant à son extremité une petite houppe de poils noirs courts, le troisième à lui seul au moins aussi long que les deux autres, le style un peu brun, n'ayant de cils qu'en dessus; yeux avec une bande noirâtre au milieu; front avancé, obtus, à poils noirâtres; à face et cavité frontale fauve, couverts de petits poils formant duvet, qui font paraître ces parties d'un blanc soyeux; thorax brun nuancé de bleuâtre, tacheté de gris et de noir, formant des zones longitudinales, couvert de poils très courts, noirs; écusson comme le thorax; abdomen chagriné, d'un beau bleu, couvert de très petits poils noirs, avec son premier anneau, et le bord antérieur du second d'un blanc sale, ayant des poils de la même couleur; pattes fauves, à poils fauves; ailes brunes. Individu mâle.

La larve, d'un blanc sale (couleur de pus), atteint près de 3 centim. de longueur (1 pouce), est glabre, ayant ses trois premiers anneaux couverts d'asperités noires et de très petites crochets, et les trois suivant portant chacun deux rangées circulaires de plus forts crochets également noirs, dirigés en arrière; les cinq segments postérieurs sont lisses; la bouche est accompagnée de deux crochets.

Sa coque a 1 centim. 7 millim. de longueur et 4 millim. de diamètre à sa partie moyenne; il va sans dire qu'elle offre sur sa peau endurcie les crochets dont nous avons parlé; l'insecte en sort faisant sauter obliquement l'extremité antérieure, comme cela se voit pour celle de l'*Hypoderma bovis*.

Je recueillis plusieurs de ces larves, le matin, dans un site où les vaches qui en étaient infestées avaient passé la nuit; elles s'enfouissaient dans la poussière; celle qui m'a fourni le Diptère décrit plus haut fut ramassé au milieu de juin, et l'insecte parfait en sorti le 4 août suivant. Ce fait eu lieu au district des mines de Marmato, dont la température moyenne annuelle est, suivant M. Boussingault, de 20°4 centig.

Habitation : la Nouvelle-Grenade.

OBS. Cette espèce est certainement très voisine du *C. cyaniventris* de M. Macquart (...); elle en diffère toutefois par son abdomen couvert par petits poils noirs, et à base à poils blanchâtres; du reste la description qu'à donné ce savant se rapporte assez bien à l'espèce qui nous occupe."

32. Joly, N., 1846: Note sur l'éxistence des larves d'Oestrides chez l'espèce humaine. *Mém. Acad. Sci. Toulouse* (1846) : 20. (Also published in the *J. Med. Chirurg. Toulouse* 9 (8): 237-243).

Not seen.

33. Joly, N., 1846-1847: Recherches zoologiques, anatomiques, physiologiques et médicales sur les Oestrides qui attaquent l'homme, le cheval, le boeuf et le mouton. *Ann. Soc. Phys. Nat. Soc. Agric. Lyon 9:* 157-305, 8 pls. (Abstract in *C. R. Acad. Sci. Paris 23* (10): 510-513).

Not seen.

34. af Rosenschöld, E. M., 1849: Entomologiska underrättelser från Paraguay. *Öfvers. Kungl. Vetensk. Acad. Forhandl. 6:* 59-62. (Also in Frorieps *Tagesbericht 1*: 65-67, 1850).

According to Keferstein (36): "So fand Rosenschöld in Paraguay sehr häufig *Oestrus*-Larven unter der Haut von Rindern, Ziegen und Hunden; mann versicherte ihm, dass sie bisweilen in den menschlichen Körper vorkommen."

35. Londres (—), 1854: On insect larvae under the human skin. *Monthly J. Med. Sci. 13*: 371.

Londres reports a case from Surinam, where the larvae are known as "mosquito-worms"; describes the wounds and the means employed in the treatment. He was not sure whether the larvae should be attributed to *Oestrus bovis* or *Oestrus hominis.*

36. Keferstein, G. A., 1856: Über *Oestrus hominis. Verh. zool. bot. Ver. Wien 6*: 637-652.

A good historical paper on *Dermatobia.*

37. Coquerell, C., 1859: Note sur une larve d'Oestride extraite du bras d'un homme à Cayenne. *Rev. Mag. Zool.* (2) *11:* 356-361, pl. 12, fig. 2.

Describes and figures a larva from Cayenne, French Guiana. Says that it agrees with the characters of the larva described by Hope (28).

38. Coquerell, C. & A. Sallé, 1859 : Notes sur des larves d'Oestrides dévelopées chez l'homme au Mexique et à la Nouvelle Orleans. *Rev. Mag. Zool.* (2) *11*: 361-367, pl. 12, figs. 1-4.

The authors describe a larva from Vera Cruz, Mexico, where it is called "moyocuil". A translation of Penniston's paper (30) is given.

39. Grube, E., 1860: Beschreibung einer Oestridenlarve aus der Haut des Menschen. *Arch. Naturges. 26:* 9-16, pl. 1, figs. 4-5. (Also published in the *Arb. Schles. Ges. Vaterl. Kultur* (1859): 25).

Reports a case from Costa Rica, observed by von Franzius, who wrote to Grube, saying that the larva was known as "torcel", probably from the Spanish "torcer" (to twist), for the larva keeps constantly twisting beneath the skin. Von Frantzius tells how he obtained the larva, describes the tumour caused by it, gives its dimensions and says that the people knew this larva was produced by a fly.

Grube gives a detailed description of the larva accompanied with figures. Says that it was very different from the one described by Goudot as *noxialis* and believes that the larva he had in hand could belong to a different genus, the all matter being satisfactorily settled only with the rearing of the larvae to adulthood.

40. Brauer, F. M., 1860: Über den sogennanten *Oestrus hominis* und dia oftmals berichteten Verirrungen von Oestriden der Säugethiere zum Menschen. *Verh. zool. bot. Ges. Wien 10* : 57-72.

A discussion on the existence of a human "oestrid". Brauer does not admit the existences of *"Oestrus hominis"*, an opinion soon changed (see next reference).

41. Brauer, F. M., (1861): Über die Larven der Gattung *Cuterebra* Clark. *Verh. zool. bot. Ges. Wien 10* (1860): 777-786.

Brauer admits the existence of the *"Oestrus hominis"*, and erects the genus *Dermatobia* for it.

The larvae and the adult were thus characterized :

"Larve der Gattung *Dermatobia* m. (*Cuterebra noxialis* G. u. *cyaniventris* Mqurt.): Länglich birnförmig, das vordere Ende dicker als das hintere. Letzteres mehr weniger dünn, von siebenten Ringe an manchmal schnell verdünnt, schwanzförmig (bei jungen Larven). Seitenwülste und den vorderen Ringen undeutlich, erst von siebenten und neunten Ringe an auffalender ausgeprägt. Haut nackt, mit Ausnahme weniger Dornenreihen am Vorderrande, (z.B. am 2.-7.Ringe) quer über die Mittle an der Rückenseite einiger (z.B. am 3.-5. Ringe) Ringe oder am Hinterrande weniger Segment. Dornen etwas gekrümmt, durchaus schwarz, wie bei reifen Larven der *Ceph.*

stimulator Clk. Zur Zeit der Reife verhornen einige Warzen an den Oberseite, über die Mundhaken ist nichts beobachtet worden, sie wurden in allen Fällen gesehen. Die Breite der Larve nimmt bis zum fünften Ringe zu und da an bedeutend ab. Hinterstigmen wie Gastrus-Larven gebaut."

"*Dermatobia* m. : Mittelgrosse, schlanke Fliegen. Stirne stark vorgezogen, Augen getrennt. Gesicht wie bei Cephenomyien gebaut. Die Fühler sitzen in einer ungetheilten Grube, die sich nach abwärts in Form einer Furche bis zur Spalte für die Mundtheile verlängert, die in ihrer Mitte laufende, rudimentär bleibende Leiste setzt sich bis zum Munde fort, woselbst sie sich theilt. Fühler schmal, die zwei ersten Glieder sehr kurz, cylindrisch, das dritte mehr als doppelt so lang, diese zusammengenommen, schmal, leistenförmig, seitlich flachgedrückt. Die Borste sitzt an der Basis des dritten Gliedes, ist dick, gerade und nach aussen lang, aber sparsam gefiedert. Backen, besonders nach unten stark blasig. Mundtheile tief eingezogen, aber ein Rüssel vorhanden. Thorax wie bei *Hypoderma;* Beine schlank, Schenckel an der Basis etwas verdickt; Schienen dünn, leicht einwärts gebogen, Tarsen nicht flach gedrückt, zart. Haftplatten und Klauen gross. Hinterleib fünfringlich, flachgedrückt, am Ende spitz. Flügeladernverlauf genau wie bei *Hypoderma,* Flügel meist rauchig, Schüppchen gross. Spitzquerader nach hinten (bei gespannten Flügel) nicht erweitert, fast gerade. (*Cuterebra cyaniventris* Mqrt., hat die grösse von *Gastrus equi* Fbr.)."

42. Laboulbène, A., 1860: Rapport sur une larve d'Oestridae extraite de la peau d'un homme à Cayenne. *C. R. Mém. Soc. Biol. Paris 3* (2): 161-166.
Not seen.

43. Laboulbène, A., 1861: Description et figure d'une larve d'Oestride de Cayenne, extraite de la peau d'un homme. *Ann. Soc. Ent. France* (4) *1*: 249-253, pl. 7, figs. 19-21. (Also published in the *Gaz. Méd. Paris* (3) *16* (31): 66-68).
Describes and figures a larva from Cayenne.

44. Coquerell, C. & A. Sallé, 1862 : Note sur quelques larves d'Oestride. *Ann. Soc. Ent. France* (4) *2*: 781-794, pl. 19.
The authors describe and figure some larvae received from Mexico, saying that they were not different from the one they had previously described (38).

45. Scheiber, S. H., 1860-1862: Vergleichende Anatomie und Physiologie des Oestriden-Larven. 2. Teile. *Sitzungsber. K. Akad. Wiss., Mathem.-Naturwiss. Cl.*, Wien, *41* (1860): 409-496, 2 pls., 33 figs.; *45* (1862): 7-68, 3 pls., figs. 34-62.
Not seen.

46. Brauer, F. M., 1863: *Monographie der Oestriden,* 8 + 6 + 292 pp., 10 pls. Kaiserlich Königlich zoologischen-botanischen Geselschaft, Wien.

47. Martius, C. F. P. von, 1863: *Beiträge zur Ethnographie und Sprachenkunde. II. Zur Sprachenkunde. Glossaria Linguarum brasiliensium. Glossarios de diversas lingoas e dialectos, que fallão os indios no Imperio do Brasil,* 548 pp. Junge & Sohn, Erlangen.
Page 484 : "Ura — animal vulgo berne."

48. Scheiber, S. H., 1863: Bericht über den sogennanten *Oestrus hominis* nach den bisherigen Standpunkt der Wissenschaft. *Wirchow's Arch. pathol. Anat. u. Physiol.* (2) *6* (26): 209-217.
Not seen.

49. Brauer, F. M., 1863: Beiträge zur Kenntniss der Dipteren. II. *Dermatobia*-Larven aus *Felis concolor. Verh. zool.-bot. Ges. Wien 14*: 894.
Brief note on the finding of a larva under the skin of that carnivore: no precise locality data furnished.

50. Bates, H. W., 1864: *The Naturalist on the River Amazons,* XII + 466 pp., illus., 1 map. J. Murray, London, 2nd. Ed.
Unimportant citations of *Dermatobia* larvae.

51. Gonzales, J. E., 1867: La mosca hominivora. *Gac. Med. Mexico 3* (9): 149-155.

Not seen.

52. Schiner, J. R., 1868: *Reise der österreichische Fregatte Novara um die Erde*. Zool. Theil, Diptera : 388 pp., 4 pls., K. K. Hof- und Staatsdruckerei, Wien.

Dermatobia : pp. 338-339. Adopts Macquart's name (*cyaniventris*) and believes that *noxialis* may be a synonym.

53. Smith, F., 1868: Observations on the economy of Brazilian Insects, chiefly Hymenoptera, from the notes of Mr. Peckolt. *Trans. Ent. Soc. London* (1868): 133-136.

"Another dipterous insect is called the 'Berna' [sic] fly, which deposits its eggs in wounds, both on man and beasts; it is a species of the genus *Trypeta* [sic] and is remarkable from having the apical segments of the abdomen into a large ovipositor. Mr. Peckolt says that negroes suffer much from the attacks of this fly, which frequently deposits its eggs in their nostrils whilst they are sleeping, and such are the effects of its attacks, that, in some cases, death ensues."

54. Bonnet, G., 1870: *Contribution à l'étude du parasitisme* (Thèse). Montpellier.

According to Blanchard (73), this thesis deals with the "ver macaque", studied by Bonnet in French Guiana, when he was a navy doctor. Bonnet said that the larvae attacked men, agoutis, pigs and dogs. Describes the wounds, and says that "un peu d'onguent mercuriel ou une goutte d'ammoniaque ou de chloroforme appliquée à l'orifice sert pour le tuer et pour arrêter les accidents. Quand le parasite est plus ancien et s'est complètement développé sous la peau, une petite operation est nécessaire pour l'extirper."

55. Posada-Orango, A., 1871: La *Cuterebra noxialis*. *L'Abeille Médicale 28*: 209-212.

Blanchard (73) gave the following abstract of this paper : "En Colombie, il n'y a pas une seule localité dont la température moyenne dépasse 18 degrées C et où les Vaches ne soient cruellement tourmentées par ce fléau. Les larves, qu'on appelle par là *Nuches* ou *Gusanos de monte* (vers de bois), sont quelquefois si nombreuses, que les Vaches que en sont affectées maigrissent notablement, et que leur peau, alterée par les trous et l'inflammation, devient impropre au commerce.

Ce n'est que dans les prés, mais dans les broussailles, qu'on rencontre la mouche qui produit ces Vers ou larves (...). C'est une très grosse Mouche, bleu foncé, avec la tête blanchâtre et les pattes fauves. Elle attaque non seulement le Boeuf, mais aussi le Chien, le Jaguar et l'homme. Le Cheval, en est exempt.

La *Cuterebra* ne fait pas de mal à travers les vêtements; c'est dire qu'elle ne pique qu'à la face ou sur des parties que se trouvent découvertes accidentellement. La piqûre est instantannée et peu douloureuse, passant même inaperçue.

(...) Quant aux symptômes généraux, excepté la manque de sommeil produite par la douleur, on peut dire qu'ils sont nuls. Je me rappelle un enfant, âgé seulement de quelques mois, qui avait huit de ces vers dans différents points du corps, et qui ne présentait aucune réaction. Le danger occasionné par leur présence peut venir plutôt de leur voisinage d'un organe important, tel que l'oeil. J'ai vu en effet plus d'une fois ces larves logées dans l'orbite; heureusement les malades étaient venus consulter opportunément, et il n'y a pas de suite fâcheuse. Ces Vers ne sont pas rares non plus dans le scrotum et sous le cuir chevelu."

56. Verrill, A. E., 1872: Additional observations on the parasitism of man and domestic animals. 5. *Annual Report Connecticut Board Agric.* (1871-1872), Hartford, Conn. (Also published in the *Amer. J. Sci. & Arts* (2) *50*: 430).

Reports an attack by *Dermatobia* in Meridian, Mississipi (probably in someone who had been in Central or South America). Not seen.

57. Zuern, F. A., 1872: *Die Schmarotzer auf und in den Körper unserer Haussaugethiere, sowie die durch erstere veranlassten Krankheiten, deren Behandlung und Verhütung. I. Thierische Parasiten*, 236 pp., 4 pls., Weimar.

According to Zuern, hides brought from Brazil to Germany obtained very low prices, due to their bad quality, since they showed numerous holes produced by *Dermatobia* larvae. Those hides were known as "Rio-hides."

58. Martins Costa, D. A., 1876: Estudo zoo-clinico sobre alguns animaes parasitas e venenosos do Brazil. *Progresso Medico*, Rio de Janeiro *1* (3): 57-62, 2 figs. (Abstract in *Gaz. Med. Bahia* (2) *1* (12): 554-556; republished in 1877, in the *Arch. Méd. Navale 27:* 312).

Describes the tumours, cites the hosts of *Dermatobia*, etc.

The greatest interest presented by this paper is the Appendix (p. 62), where Martins Costa reproduced an unpublished manuscript by Alexandre Rodrigues Ferreira, on the "berne" :

"Hura ou berne, especie de inseto. Corre entre os tapuyas como certo que elle não e mais do que a larva do mosquito carapaná. O seu aspecto, quando pequeno, é o de um vermiculo filiforme, que pelo tempo adeante vae crescendo até mais de pollegada de comprimento, mais grosso no centro, com duas sedas na cabeça, esta com seu aculeo setaceo no logar da boca, dentro em seu estojo, como o dos mosquitos, e o corpo igualmente semeado de sedas. Introduz-se por entre a pelle e a carne, em toda e qualquer parte do corpo, e alli causa um desesperado prurido, ao qual se segue a phlogose, a febre, o delirio, &c. Para se dissipar usa-se do sarro de cachimbo, para o atordoar, e expreme-se depois com a unha. Eu tenho visto principalmente os gentios muito inçados delles pela cabeça, dorso, pernas, dedos, &c."

Unfortunately, Martins Costa did not tell the date of the manuscript, but we may situate it between 1783 and 1792, the period spent by Rodrigues Ferreira exploring the northern regions of Brazil.

59. Jacobs, M., 1882: De la presence des larves d'Oestrides et de Muscides dans le corps de l'homme. *C. R. Soc. ent. Belg 27*: CL-CLX.

Not seen. A short note regarding *Dermatobia* on man from South America.

60. Jacobs, M., 1883: On the presence of Oestridean and Muscidean Larvae in the human body. Translated, with foot-notes, references and remarks, by T. S. Cobbold. *Veterinarian* (1883) : 8 pp.

Not seen.

61. Laboulbène, A., 1883: [Larve d'un diptère parasite, la *Dermatobia noxialis*]. *Ann. Soc. Ent. France* (6) *3*: XCII (Bull.).

A short note. Laboulbène tried to rear the larva, but it died a few days before pupation.

62. Laboulbène, A., 1883: Examen de la larve vivante d'un insecte diptère du Brésil (*Dermatobia noxialis*) observée à Paris. *Bull. Acad. Méd. Paris* (2) *47*: 729-731.

Not seen.

63. Jousseaume, F. & J. P. Mégnin, 1884: Note sur la présence d'une larva d'Oestridae (*Dermatobia noxialis* J. Goudot) chez l'homme, à Paris. *Bull. Soc. Zool. France* (6) *9*: 114-116.

64. Mégnin, J. P., 1884 : Un deuxième cas de tumeur causée par une larve d'Oestridae observée en France chez l'homme. *C. R. Soc. Biol. Paris* (8) *1* (11): 143-145.

65. Bordier, A., 1884: *La Géographie Médicale*, XXIV + 662 pp., 21 pls. Bibliothèque des Sciences Contemporaines, n.° 10. C. Reinwaldt, Libraire-Éditeur, Paris.

Some comments on *Dermatobia* at page 390.

66. Matas, R., 1887: Report of a case of a patient from whose subcutaneous tissues three larvae of a species of *Dermatobia* were removed, with remarks. *New Orleans Med. Surg. J.* (n.s.) *15* (*3*): 161-179, 4 figs.

Reports a case of a patient which came from Honduras, attacked by three larvae. Matas said that those occurrences were not rare, since the beginning of the construction of the Canal of Panama, where the workers became infested.

67. Brauer, F. M., 1887: Nachtrage zur Monoghaphie der Oestriden. II. Zur Charakteristik und Verwandtschaft der Oestridengruppen im Larven- und volkommenen Zustanden. *Wien. Ent. Zeitschr. 6:* 4-16.

See chapter 4.

68. Matas, R., 1888: A man-infesting bot. *Insect Life 1*: 76-80, 3 figs.

An abstract of his former paper (66).

69. Osborn, H., 1889: Another human bot-fly. *Insect Life 1*: 226.

70. James, J. F., 1889: A human parasite. *Amer. Naturalist 23*: 65.

71. Brauer, F. M. & J. von Bergenstamm, 1889: Die Zweiflügler des Kaiserlichen Museums zu Wien. IV. Vorarbeiten zu einem Monographie des Muscaria Schizometopa (exclusive Anthomyidae). Pars 1. *Denkschr. Nat. Kais. Akad. Wiss. 56*: 69-180, 11 pls.

Page 159: The authors give a key to the genera of "Oestridae" and cite only the species *cyaniventris* in the genus *Dermatobia.*

72. Anon., 1890: The man-infesting bot. *Insect Life 2*: 386.

73. Blanchard, R., 1892: Sur les Oestrides américains dont la larve vit dans la peau de l'homme. *Ann. Soc. Ent. France* (7) *2* : 109-154, 12 figs. (An abstract with the title "The American bot-flies whose larvae live in the skin of man" was published in *Insect Life 5* (1) : 2-3, 1892, the French paper was also separately printed, with the same title, in 1892, with 46 pp.).

Blanchard gives an annotated bibliography, reproducing the descriptions and illustrations presented by La Condamine, Arture, Linnaeus Jr., Humboldt, Say, Hill, Howship, Roulin, Guyon, Hope, Penniston, Goudot, Londres, Coquerell, Coquerell & Sallé, Grube, Brauer, Laboulbène, Smith, Bonnet, Verrill, Posada-Arango, Martins Costa, Jousseaume & Mégnin, Matas, etc.

Redescribes several of the larvae, and after considering the different opinions expressed by former authors, concludes with the following remarks:

"Dans la zone intertropicale de l'Amérique, il est fréquent de voir des larves d'Oestrides se développer dans l'épaisseur de la peau de l'homme et de divers animaux. Ces Oestrides appartiennent à différents genres : ceux qui s'attaquent à l'espèce humaine sont toujours du genre *Dermatobia* Brauer (...).

On peut distinguer plusieurs espèces de Dermatobies, dont aucune ne s'attaque exclusivement à l'homme; en effet, on peut observer chez les Mammifères sauvages ou domestiques des larves identiques à celles qui se rencontrent chez l'homme. L'ancienne croyance à l'éxistence d'un *Oestrus hominis* est donc définitivement ruinée.

De l'étude à laquelle nous nous sommes livrée, il résulte que les larves de Dermatobies jusqu'à présent observées dans l'espèce humaine appartiennent á *quatre espèces distinctes,* que nous énumérons ci-dessous. L'état parfait n'est connu que pour une seule : aussi avons-nous cru devoir adopter, pour distinguer ces larves, les noms vulgaires qu'on leur donne en Amérique; ces noms acquièrent ainsi une signification précise.

1.° *Ver macaque.* — Son état parfait est representé par *Dermatobia noxialis* Goudot (...). C'est à elle que se rapportent les observations de Say [17], de Goudot [31], de Matas [66] (...).

2.° *Torcel.* — Son état parfait est inconnu; on le rapporte à tort à *Dermatobia cyaniventris* Macquart. (...). C'est à elle que se rapportent les observations de Penniston [30], de Grube [39], de Brauer [41], de Laboulbène [43], de Posada-Arango [55] (...).

3.° *Berne.* — Son état parfait est inconnu; on le rapporte parfois à *Dermatobia cyaniventris,* mais c'est là une pure présomption. (...). C'est à elle que se rapporte l'observation de Howship [23], (...).

4.º *Ver moyocuil.* — Son état parfait est inconnu. La larve a été décrite par Coquerell [37]; elle est presque identique au torcel, dont elle différe cependant en ce que la ceinture ne se poursuit pas sur les faces latérales et ventrales du troisième segment, ainsi que par l'absence de la rangée supplémentaire de crochets sur le septième anneau (...). Les larves figurées par Hope [28], sans indication de provenance [sic], et par Coquerell et Sallé [38], sont trop mal representées pour pouvoir être sûrement attribuées au Ver moyocuil; nous croyons cependant qu'elles s'y rapportent, plutôt qu'au Torcel (...). [We have substituted Blanchard's original numeration by the numbers of our references].

On peut résumer par le tableau synoptique suivant les caractères différentiels qui permettront de distinguer les unes des autres les quatre sortes de larves de Dermatobies que nous sommes parvenus à séparer spécifiquement:

2e. et 3e. segments:

a. hérissés de très fines spinules ..... Ver macaque
a'. lisses, sans spinules. — Bord postérieur du 8e. segment :
b. avec rangée de crochets en antéversion, à la face dorsale ..... Berne
b'. sans rangée de crochets. — Bord antérieur du 8e. segment :
c. avec ceinture de crochets complètes .....:... Torcel
c'. à ceinture manquant à face ventrale ..... Ver moyocuil

Certaines autres espèces de Dermatobies s'attaquent à divers Mammifères. Aucune d'elles n'ayant encore été observé chez l'homme, nous n'avons pas cru devoir les envisager dans notre étude, mais il est vraissamblable que l'une ou l'autre d'entre elles se rencontrera quelque jour dans l'espèce humaine."

According to Townsend (214) the "torcel" and the "moyocuil" in Blanchard's acception are stage III, while the "berne" is stage IV of *Dermatobia.* The figures Blanchard reproduced correspond in the following manner to the larval stages : fig. 2 : larva I; figs. 3, 8, 9 and 10 : larva II; figs. 4, 5, 7 and 11 : larva III; figs. 6 and 12 : larva IV (214, p. 231).

74. Magalhães, P. S., 1892: *Subsidio ao estudo das myiases*, 82 pp., Typographia do Brazil, Rio de Janeiro. (Abstract in *Gaz. Med. Bahia* (4) *3* (2): 86-89).

The author presents a report on the "bicheiras" or myiases caused by calliphorids, and some observations on *Dermatobia.*

75. Blanchard, R., 1892: Note aditionelle sur les Oestrides américains dont la larve vit dans la peau de l'homme. *Ann. Soc. Ent. France* (7) *2*: CCIX-CCXI (Bull.).

A review of Magalhães' paper, above cited.

76. Barraillier, E., 1892: Viaje a Andamarca y Pangoa. Fechado en Jauja a 22 de noviembre de 1892. *Bol. Soc. Geograf. Lima 2.*

"La segunda enfermedad particular de Pangoa es la *Mirunta.* Es una dolencia muy curiosa y única en su género. Las personas que padecen de ella son sorprendidas una mañana por un dolor muy agudo en cierta parte del cuerpo. Se registran con minuciosidad y ven una hinchazon con tintes coloridos y morados en la punta. Abriendo ese bulto se escapa un gusano grueso que está metido entre la cútis y la carne, el cual habia ocasionado con su presencia inoportuna los dolores referidos.

Segun observaciones de un amigo mio que se quedó algunos meses en Pangoa, proviene esa enfermedad de dejar la ropa tendida después de puesto el sol; entonces vuelan muchas moscas que se van a poner sobre la ropa, depositan sus huevos y se van, dejando semilla de algunos gusanos, los cuales, puestos a luz por el calor del cuerpo, se introducen incontinente en los poros para fijarse después en la parte más conveniente a sua apetito. El único remedio es hacer una operación y sacarlo.

Los preservativos son : recoger la ropa antes de que se ponga el sol, y bañarse con frecuencia."

77. Brauer, F. M. & J. von Bergenstamm, 1893: Die Zweiflügler des Kaiserlichen Museums zu Wien. VI. Vorarbeiten zu einer Monographie des Muscaria Schizometopa (exclusive Anthomyidae). Pars III. *Denkschr. Nat. Kais. Akad. Wiss. 60:* 89-240.

Cites *Dermatobia* in the key, with the species *cyaniventris* (p. 181).

78. Blanchard, R., 1893: Note sur les larves de *Dermatobia* provénant du Brésil (Diptère). *Ann. Soc. Ent. France* (7) *3*: XXIV-XXVII (Bull.).

Blanchard received from Silva Araujo, from Brazil, several larvae of *Dermatobia*, which were identified as Torcel, and one referred to the Berne. He received also two insects, believed to the adults of the Berne: one was a Tipulidae and the other *Dermatobia cyaniventris*. Blanchard makes some comments on the morphology of the larvae, and believes that *cyaniventris* could be the adult of the Torcel.

79. Smith, H. H., 1893: Screw worms and the man-infesting bot in Brazil. *Insect Life 5*: 265-266.

Brief comments on *Dermatobia*. Says that people usually "tie a bit of fresh pork-fat tightly around the wound; the maggot is thus deprived of air and in the effort to obtain it, emerges from the skin."

80. Sangalli, G., 1893: Echinococchi, larve d'*Oestrus* grosse corna nell'uomo. *Gazetta Med. Lombarda 53* (35): 423-424.

Reports two cases of attack by *Dermatobia* in men coming to Italy from São Paulo, Brazil.

81. Dugés, A., 1894: [Title unknown]. *El Universal*, Mexico, July 15, 1894.

According to Blanchard (89), reports the existence of *Dermatobia* in the eastern region of Guerrero, Mexico.

82. Blanchard, R., 1894: Contributions à l'étude des Diptères parasites (2e. série). *Ann. Soc. Ent. France* (7) *3*: 142-160.

More remarks on larvae sent to him from Brazil. Lists some insects mistaken for *Dermatobia* (see chapter 3).

83. Breda, A., 1895: *Dermatobia noxialis* (*Cuterebra noxialis* Goudot). Caso clinico. *Riv. Veneta Sci. Med. 22* (10): 467-472, 4 figs.

Not seen.

84. Austen, E. E., 1895: On the specimens of the genus *Cutiterebra* and its allies (family Oestridae) in the collection of the British Museum, with description of a new genus and three new species. *Ann. Mag. Nat. Hist.* (6) *15*: 377-396, pl. 13.

"*Dermatobia cyaniventris* Macq. — One female from Ega, R. Amazons, Brazil (Bates). In spite of the fact that, as pointed out by Goudot (...) Macquart does not mention that the abdomen of *C. cyaniventris* is clothed with short black pile, with whitish (yellowish) pile at the base, there can be no doubt the description of the two authors refer to the same species."

85. Magalhães, P. S., 1895: [*Dermatobia* — Abstract of paper Read al May 14]. *Bull. Soc. Zool. France 20* (5): 116-118.

Not seen.

86. Magalhães, P. S., 1896: Observations sur les Dermatobies (Extrait d'une lettre addressée à R. Blanchard). *Bull. Soc. Zool. France 21* (8): 178-179.

Not seen.

87. Altamirano, F., 1896: Datos para el estudio de la myiasis cutánea causada por el Moyocuil. *An. Inst. Méd. Nac. Mexico 2*: 64-69, 82-90, pls. 7-9.

Several comments on *Dermatobia*, and on the thesis of Serna, which seemed to have described the species as new, under the name *mexicana* (see chapter 4).

88. Blanchard, R., 1896: Nouvelles observations sur les larves de *Dermatobia noxialis*. *Bull. Soc. Centr. Méd. Vét.* (n.s.) *14*: 527-583, 3 figs.

Believes that all the reports of attacks by *Dermatobia* larvae on man and animals are to be referred to *noxialis*, and that the larvae of *cyaniventris* are still unknown.

89. Blanchard, R., 1896: Contribution à l'étude des Diptères parasites (3e. série). *Ann. Soc. Ent. France* (7) *6*: 641-677, pl. 17, figs. 10-13.

"...ayant mis en culture huit *Bernes* extraits de la peau du boeuf à Guaratingueta (nord de l'État de São Paulo), [P. S. Magalhães] constata que l'un deux avait accompli sa métamorphose. Le puparium s'était ouvert obliquement; on reconaissait facilement à sa surface les saillies, dépressions et crochets caractéristiques du *Berne*. La Mouche était morte, les ailes complètement déployées; elle avait donc dû mourir aussitôt après son éclosion, avant d'avoir pu voler. Cette Mouche avait l'abdomen d'un bleu foncé brillant, la tête d'un fauve jaunâtre; les yeux très écartés et très bruns; le front et la partie moyenne et terminale du ségment céphalique très saillant; la face supérieure du thorax couverte de poils noirs.

Ce précieux Diptère fut soummis à l'examen du professeur Fr. Brauer, que le trouva identique à l'exemplaire de *Dermatobia cyaniventris* (Macquart), possédé par le Musée de Vienne. Il est donc demonstré que le *Berne* (sensu stricto) est le dernier état larvaire de la *Dermatobia cyaniventris*.

Comme il a été établi d'autre part que le *Berne* est la larve de la *Dermatobia noxialis* (Goudot, 1845) il en résulte que cette dernière n'est pas une espèce valable, mais doit tomber en synonymie; elle est identique à la *Dermatobia cyaniventris* (Macquart, 1840)."

90. Magalhães P. S., 1897: O Berne. Uma nova phase no estudo do berne. *Jornal do Commercio*, Rio de Janeiro, January 2, 1897 (Also separately printed, same year, 7 pp.).
Not seen.

91. Magalhães, P. S., 1897: Subsidio ao estudo das myiases (aditamento ao de 1892). *Jornal do Commercio*, Rio de Janeiro, January 2, 1897.
Not seen.

92. Folkes, M. M., 1897: The gusano worm and its treatment. *Med. Rec.*, New York *51* (2): 50.
On the use of hypodermic injections of chloroform to anesthetize the larva, which is then extracted with a needle inserted in the skin, through the orifices produced by the larva.

93. Magalhães, P. S., 1898: Subsidio ao estudo das myiasis, o berne. Uma nova phase no estudo do berne. *Gaz. Med. Bahia 1* (11): 508-520.
Not seen.

94. Schmalz, J. B., 1901: Zur Lebensweise der Brasilianischen Dasselfliege (*Dermatobia cyaniventris*). *Insekten-Boerse 18* (28): 220-221.
Not seen.

95. Rodriguez, E., 1903: Parasitos tropicales. *Gaceta Medica 20.*
Not seen.

96. Guevara Rojas, F., 1903: [Title unknown]. *Curiosidades Patologicas 10.*
Not seen.

97. Ward, H. B., 1903a: On the development of *Dermatobia hominis*. *Mark Anniv. Vol.*: 483-513, pls. 35-36.
Not seen. Cites *Simulium* sp. as vector.

98. Ward, H. B., 1903b: Some points in the development of *Dermatobia hominis*. *Stud. Lab. Nebraska 58*: 1-10. (Also published in the *New Orleans Med. Surg. J. 56* (4): 243-252, 2 figs.).
Not seen.

99. Brooks, H., 1904: A case *of Dermatobia hominis* with demonstration of larva. *Proc. N. Y. Pathol. Soc.* (n.s.) *4* (6): 128-129.
Not seen.

100. Blanchard, R., 1904: La *Dermatobia cyaniventris* existe-t-elle à la Martinique? *Rev. Méd. Hyg. Trop. 1* (1-2): 26-29, 2 figs.
Not seen.

101. Tamayo, M. O., 1904: La *Dermatobia cyaniventris*. Estudio zoológico de un diptero americano. *Crón. Med.*, Lima *21*: 276-283, 295-299.
Not seen.

102. Rangel, R., 1905: Larvas cuticolas de America. *Bol. de los Hospitales 10.*
Not seen.

103. D'Empaire, A., 1905: Gusano de monte extraído del saco lacrimal. *Rev. de la Beneficiencia*, Maracaibo.
Not seen.

104. Duprey, A. J. B., 1906: The mosquito worms of Trinidad and their real nature. *J. Trop. Med. 9*: 22-23.

Not seen.

105. Barrett, O. W., 1906: Notes on the man-infesting bot in Mexico. *Proc. Ent. Soc. Washington 8*: 3-4.

Small note on a case observed at Tuxtla, near Vera Cruz. The larva was extracted with a "chicle" made with the gum of *Achras sapota.*

106. Bau, A., 1906: Diptera, Fam. Muscariidae, subfam. Oestrinae, *in* P. Wytsman: *Genera Insectorum 43:* 1-31, 2 pls.

Dermatobia: p. 27, pl. 2, figs. 19, 19a.

107. Rondon, C. M. S., 1907: Relatório da Comissão Rondon. 1. Estudos e reconhecimentos. *Com. de Linhas Telegráficas e Estratégicas de Mato Grosso ao Amazonas 1*: 1-363, illus., map.

"Dizem os habitantes do Jamary que existe um mosquito que deposita as larvas na pelle dos animaes e mesmo do homem, o que aqui registramos à titulo de curiosidade, porquanto são conhecidos os modos de evolução dos culicideos em geral.

Disseram os meus informantes que o referido é chamado *Carapanã de Oura."*

108. Mouchet, A. & L. Dyé, 1908: Contributions à l'étude des larves cuticoles d'oestrides américains. *Rev. Méd. Hyg. Trop. 5* (4): 262-276, 2 figs.

Not seen.

109. Neiva, A., 1908 : Contribuição ao estudo da biologia da *Dermatobia cyaniventris* Macq. *Brasil-Médico,* Rio de Janeiro *22*: 311-312. (Reprinted in the same year in the *Trabalhos do Instituto de Manguinhos,* 8 pp., Typ. Besnard Frères, Rio de Janeiro).

Abstract in *Rev. Entom.,* Rio de Janeiro *11*: 18 (1940), by T. Borgmeier:

"Trata-se dos primeiros estudos feitos em Manguinhos sôbre a biologia do berne, tendo sido verificado o tempo de penetração das larvas na terra, quando abandonam o hospedeiro, comprovação esta pela primeira vez feita, levando 10 a 15 minutos se o terreno era frouxo, ou mais de duas horas se era de maior firmeza, e quando não penetravam, transformavam-se em pupa sôbre êle. Neiva verificou que o tropismo pela terra é tão grande, que, mesmo quando as larvas se mostravam inteiramente imobilizadas, se eram postas em contacto com o solo, recuperavam os movimentos, tentando penetrá-lo. Comprovou ainda que as larvas quando não penetram no solo, transformam-se em pupas sôbre êle, não se transformando porém em imagens. Pela primeira vez determinou o tempo de duração do estádio pupal, que varia de 33 a 37 dias no Rio de Janeiro. Transplantou também a larva do berne do homem para um animal, conseguindo que evolvesse, tendo ainda verificado que uma larva pode deslocar-se pelo menos 4 metros do ponto em que abandonou o animal. Neiva conseguiu fazer a verificação de que uma *Dermatobia* leva pelo menos 100 dias para completar o ciclo evolutivo. Comprovou também, pela primeira vez, que a larva do berne dos animais ao dar imagem, origina a mesma espécie que a larva cultivada de homem, fato apenas suspeitado e pela primeira vez resolvido com segurança, isso por ter obtido uma *Dermatobia* adulta originada de berne humano, e que fôra cultivada pelo prof. Miguel Pereira em setembro de 1902 e que a guardava como curiosidade. Neste trabalho é também, pela primeira vez, descrito o acasalamento da espécie, comprovando que uma fêmea é copulada, pelo menos, duas vêzes. A cópula pode ocorrer horas depois das imagens terem saído. Verificou, com os animais em experiência, que os cães destroem as imagens, quando percebem o inseto pousado sôbre êles, tragando-o quando o alcançam. Verificou ainda o modo da imagem sair nascendo com as asas encolhidas, pouco tempo depois se desdobram, e observou que muitas môscas não conseguem atravessar a camada de terra que cobre as pupas, morrendo ao lado do casulo."

110. Posada-Berrio, L., 1909: Larves cuticoles d'oestrides américains. *Rev. Méd. Hyg. Trop. 6* (3): 194-197.

Not seen.

111. Neiva, A., 1910: Algumas informações sôbre o berne. *Chácaras e Quintais*, São Paulo *2* (1): 3-8, 10 figs.

Abstract in *Rev. Entom.*, Rio de Janeiro *11*: 25 (1940), by Thomaz Borgmeier:

"O autor neste trabalho que é o segundo sôbre o assunto, dá o resultado de suas pesquisas após 2 anos da sua primeira comunicação. Pela primeira vez aplica a lei da prioridade, denominando de *Dermatobia hominis* L. Jun. 1788 [sic] à espécie, conhecida geralmente pelo nome de *cyaniventris* e *noxialis* que lhe deram Macquart em 1843 e Goudot em 1845. Dá a área de disseminação da espécie, desde os Estados Unidos [sic] até o sul do Brasil, prevendo que possa ser encontrada na Argentina, Uruguai e Paraguai, como depois se verificou. Mostra que o berne é mais comum em certos estados brasileiros, podendo variar sua freqüência mesmo dentro de um Estado, e é o primeiro a assinalar a inexistência do parasita nas zonas flageladas pela sêca. Dá a lista dos animais até então observados parasitados pela *Dermatobia* (...).

Registra o fato da *Dermatobia* ter vida essencialmente diurna. Também é o primeiro a verificar que as posturas são parceladas, variando de 6 a 14 ovos, podendo desovar até mais de 800 ovos. Neste trabalho são reproduzidos pela primeira vez os ovos da *Dermatobia*. Demonstra que a pupa, quando exposta ao sol, não se desenvolve, e aponta o fato que os campos limpos, carrascais, restingas, caatingas, têm uma vegetação imprópria ao desenvolvimento do parasita. Neste trabalho refere ainda que o povo denomina certos tipulídeos de "mosquito berne", atribuindo errôneamente a êsses dípteros a disseminação do parasita."

Borgmeier does not mention in his abstract of Neiva's paper the following other insects misidentified with *Dermatobia*, cited by the latter : *Ornidia obesa* (Fabr.), *Mesembrinella* sp., and *Atractocerus brasiliensis* Lep. & Serv. (cited by Serna *in* Altamirano, 1896).

112. Bernardez, M., 1910: Quanto perde o Brasil por carrapato e berne? *Chácaras e Quintais*, São Paulo *1* (5): 34-35, 1 fig.

113. Zepeda, P., 1911: [Title unknown]. *Presse Médicale* (1911).

Some comments on the vectors of *Dermatobia*.

114. Morales, R., 1911: Una observación de la manera como se transmite al hombre el colmoyote *Dermatobia noxialis*, *Cuterebra noxialis*, por Rafael Morales. Transmissión de las larvas del colmoyote (*Dermatobia noxialis*) por intermedio del *Culex*. *El Nacional*, Guatemala, December 1911. (Reprinted in Rincones & Guyon, 1945).

Morales received a *Culex* (?) from the region of Quiriguá, Guatemala, labelled "zancudo portador de colmoyotes", with 8 eggs glued to its abdomen. After 6 days, when the mosquito was placed in his hand, he saw a larva crawling out of the egg. One of those larvae was reared in the arm of a man. After 37 days, the larva being too much developed, it was transferred to a rabbit. Some time later the experience was interrupted, but the study of the larva demonstrated that it was from *Dermatobia noxialis*. Morales states, then, based on this experiment, that *Dermatobia* eggs are transported to the hosts through mosquitoes.

115. Busck, A., 1912: On the rearing of a *Dermatobia hominis* Linnaeus. *Proc. Ent. Soc. Washington 14*: 9-11.

The author has been able to rear one larva, with which he became infested at Cabima, Panama.

116. Gonzalez-Rincones, R., 1912: El aeroplano del gusano macaco. *El Universal*, Caracas, November 1912. (Reprinted in Rincones & Guyon, 1953).

The author comments the studies of Nuñez-Tovar (which, as it seems, were never published) on the vectors of *Dermatobia*. The larvae are known as "nuche", "nunche" or "gusanos de zancudo."

117. Gonzalez-Rincones, R., 1913: El aeroplano guatemalteco del gusano macaco *El Universal*, Caracas, December 12, 1913. (Reprinted in Rincones & Guyon, 1953).

Republishes the article of Morales (114).

118. Knab, F., 1913: The life-history of *Dermatobia hominis*. *Amer. J. Trop. Dis. Prev. Med. 1* (6): 464-468.

Comments the papers of Blanchard (73), Ward (97, 98), Neiva (111) and says that in the "Isthmus of Tehuantepec (...) [it] was warmly defended by the natives (...) that certain large mosquitoes (*Psorophora*) were pointed out (...) as the "madre del gusano" (mother of the worm)."

119. Arias G., J. M., 1913: El tórsalo. *Bol. Fom.*, San José *3* (5): 354-357, (7): 503-508, (8): 579-582, (9): 649-655, illus.

Not seen.

120. Van der Laat, (—), 1913: Algunas notas sobre otra plaga del ganado. El tórsalo. *Bol. Fom.*, San José: 264-266.

Not seen.

121. Morales, R., 1913: Comprobaciones a nuestro trabajo sobre la *Dermatobia cyaniventris* publicado en 1911. *La Juventud Medica*, Guatemala *13* (12): 4-8.

Not seen.

122. Surcouf, J., 1913: La transmission du Ver macaque par un moustique. *C. R. Acad. Sci. Paris 156*: 1406-1408, 2 figs. (Abstract in *Rev. Applied Ent.* (B) *1* (7): 106-107, 1913).

"Le Dr. Gonzalez Rincones, de Caracas, vient de me faire savoir que les oeufs de *Dermatobia* sont pondus sur les feuilles, dans les lieux humides fréquentés par les *Janthinosoma;* le même correspondant m'a envoyé en outre des Moustiques porteurs d'oeufs.

Il résulte de l'étude que nous avons faite de ces derniers qu'ils sont réunis en paquets, enduits d'une substance cémentaire fortemente adhérente, et lestés de façon telle que le pôle antérieur comprenant la tête de la larve, le micropyle et la zone d'éclatement soient placés en bas. La substance cémentaire se ramollit dans l'eau et redevient visqueuse. Nous croyons dès lors que les oeufs, faiblement collés sur les feuilles, s'attachent aux *Janthinosoma* qui se promènent sur ces dernières; ceux qui s'attachent à l'abdomen y restent fixés; le thorax est protégé par les hanches et les cuisses allongées, et les oeufs qui restent collés aux pattes et aux ailes se détachent pendant la marche ou le vol de l'insecte.

L'ouef mûrit, s'ouvre et la larve y séjourne, saillante à l'extérieur, jusqu'à ce qu'elle se laisse tomber sur le Vertébré piqué par le *Janthinosoma.*

Nous figurons ici un de ces moustiques; les oeufs sont très allongés, agglomérés en un faisseau serré, sont d'un jaune très pâle; près du micropyle on distingue un petit volet, unciforme, qui donne issue à la jeune larve. Celle-ci porte, à sa partie inférieure, sur les deux derniers segments, de courtes épines pâles, dirigées vers la tête; c'est au moyen de ces épines que la larve se maintient, saillante au dehors, en attendant le moment propice pour abandonner le moustique qui la porte et se fixer sur son nouvel hôte.

Au premier stade de développement, la larve (fig. 2) formée de 12 segments, porte des antennes pourvues chacune de deux points ocelliformes à leur base. Les pièces buccales sont constituées par deux lames chitineuses élargies, multifides sur les bords latéraux, et appuyées à une autre lame armée de deux paires de crochets; les plus externes sont bifides, les seconds sont simples et s'articulent avec le pharynx. Cet organe, fortement chitinisé, se prolongue jusqu'aux quatrième segment et n'est continué a ce stade de développement par aucun appareil digestif differencié. Le tégument externe de la jeune larve est recouvert de nombreuses petites épines sur les sept premiers segments; les cinquième, sexième et septième segments portent, à leur bord antérieur, une couronne de grosses épines noires en forme d'aiguillons de rosier. Sur le dernier segment s'ouvrent les deux stigmates postérieurs, chacun d'eux se compose de deux fentes; il n'y a pas encore de

stigmates antérieures. Dès que la larve s'est fixée sur le corps du Vertébré, elle penètre sous la peau et s'y transforme; à la suite de cette mue, les épines postérieurs qui maintenaient la larve dans la coque de l'oeuf disparaissent, et les fentes stigmatiques postérieures sont au nombre de trois pour chacun des deux stigmates."

123. Urich, F. W., 1913: Mosquitos of Trinidad. *Proc. Agric. Soc. Trinidad and Tobago 13* (10): 525-530.

"*Janthinosoma lutzii* has been found by Dr. Nuñez-Tovar to be the carrier of the eggs of *Dermatobia* (mosquito worm) to man and animals."

124. Piazza, A., 1913: *Dermatobia cyaniventris* — Ura de Misiones. *Rev. Fac. A. V.*, La Plata *10* (3): 178-181.

Not seen.

125. Zepeda, P., 1913: Nouvelle note concernant les moustiques qui propaguent les larves de *Dermatobia cyaniventris* et de *Chrysomyia macellaria* et peut-être celle de Lund, et de la *Cordilobia anthropophaga*. *Rev. Méd. Hyg. Trop. 10* (2): 93-95.

Not seen.

126. Picado, C., 1913: Historia de los tórsalos bovinos. *Bol. Fom.*, Buenos Aires (1913): 720.

Not seen.

127. Roosevelt, T., 1914: *Through the Brazilian wilderness*, 374 pp., illus., map. J. Murray, London.

Page 141: "At the close of the day, when we were almost back at the river, the dogs killed a jaguar kitten (...). The loathsome berni [sic] flies, which deposit eggs in living being — cattle, dogs, monkeys, rodents, men — had been at it. There were seven huge, white grubs making big abcess-like swellings over its eyes. These flies deposit their grubs in men. In 1909, on Colonel Rondon's hardest trip, every man of the party had from one to five grubs deposited in him, the fly acting with great speed, and driving its ovipositor through clothing [sic]. The grubs cause torture; but a couple of cross cuts with a lancet permit the loathsome creatures to be squeezed out."

Page 215: "At one camp three Nambiquaras paid us a visit (...). One seemed very sick; he was thin, and his back was scarred with marks of the grub of the loathsome berni [sic] fly."

128. Umaña, R., 1914: *Étude général des myiases*, 87 pp., illus., Thèse, Paris.

Describes the prothoracic spiracles of the larvae of *Dermatobia*.

129. Cockerell, T. D. A., 1914: *Dermatobia* in Guatemala. *Entomologist*, London *47*: 131.

"In February 1912, at Quiriga, Guatemala, my wife heard an Indian screaming with pain, and found that there was a dipterous larva under the skin of his arm. The larva was extracted, and I find that it agrees exactly with descriptions and figures of *Dermatobia*..."

130. Neiva, A., 1914: Informações sôbre o berne. *Mem. Inst. Oswaldo Cruz*, Rio de Janeiro *6*: 206-211, pls. 27-28.

Abstract in *Rev. Entom.*, Rio de Janeiro *11*: 42 (1940), by Thomaz Borgmeier:

"O autor, a propósito de uma nota de Surcouf, faz um apanhado dos conhecimentos relativos à *Dermatobia hominis* até a data do trabalho, relatando o encontro por Lutz de um exemplar de *Anthomyia heydenii*, portador de ovos análogos aos representados por Surcouf. Contesta o trabalho de Tovar que diz ter podido criar larvas com 15 dias de vida. Afirma que ainda está um pouco incrédulo a respeito da colocação de ovos de *Dermatobia* sôbre insetos e conta que, apesar de estar estudando o assunto há 5 anos, tendo reunido larga cópia de material e observado o inseto na natureza, nunca viu penetrar uma larva através da pele, embora tenha visto muitas dermatóbias pousadas em bois e cavalos. O autor contesta a hipótese de Bouvier, admitindo várias espécies de *Dermatobia*, e diz que, embora não negue a hipótese de os mosquitos serem os veiculadores dos ovos da *Dermatobia*, prefere esperar fatos posteriores."

Neiva adds to the list of insects misidentified with *Dermatobia* the "caranaña-ora" from Amazonia, wich is, according to him, an Ichneumonidae. Cites also *Echinomyia*, from Mato Grosso.

131. Bertoni, G. T., 1915: Hypoderma e a berne ou estro americano. *Almanack Agric. Brasil.*, São Paulo (1915): 239-242.

132. Lahille, F., 1915: *Nota sobre la "ura" y otras larvas daniñas de dípteros*, 18 pp., 7 figs., 2 pls. Ed. Ministerio de Agricultura, Buenos Aires.
Not seen.

133. Sambon, L. W., 1915: Observations on the life-history of *Dermatobia hominis* (Linnaeus Jr., 1781). *Trop. Dis. Res. Fund, Advis. Comm. Report for 1914*: 119-150, London.
A complete survey of the previous literature and biology of *Dermatobia.*

134. Townsend, C. H. T., 1915: On the reprodutive and host habits of *Cuterebra* and *Dermatobia. Science 42*: 253-255.
"*Dermatobia* parasitizes not only man, but many of the larger mammals. Such animals do not live in burrows or frequent regular runways or places of concealment. Thus *Dermatobia* can not hope to reach its hosts by employing the methods of *Cuterebra.* It has a much smaller fecundity, less than eight hundred according to Neiva of Brazil, which indicates that it adopts some method much more apt than that of *Curetebra,* to connect with the host. Its maggots are very common in cattle, dogs and men in South and Central America, yet among the natives no one seems able to identify the fly that deposits the egg. The indigenes of South America accuse a variety of dipterous insects of mothering these maggots.
Within the past decades, observers in Central and South America have discovered a number of instances of mosquitoes uniformly of the genus *Janthinosoma,* bearing a cluster of eggs attached by their ends to the under surface of the body (...).
Judging from the accounts of both natives and foreigners who have been infested with *Dermatobia* maggots, several distinct species of blood-sucking Diptera may be employed for the fly for carrying its eggs (...).
As to the exact *modus operandi* in the case of *Dermatobia,* it is quite certain that oviposition on foliage is not practised, but that the fly captures the elected carrier and holds it while gluing the egg firmly by their caudal end to the underside of its body, leaving the cephalic end of the eggs free and in such position that it will come in immediate contact with the skin of the animal bitten by the carrier. Once the carrier alights on a warm-blooded animal, the heat of the latter's body causes the maggot to spring the lid of the chorion and to work its way rapidly into the skin, most probably by way of a hair follicle (...)."

135. Ferraris, J. B., 1915: La Ura. *Rev. Assoc. Rural Uruguay 44* (6): 363-365.
Not seen.

136. Knab, F., 1916: Egg-disposal in *Dermatobia hominis. Proc. Ent. Soc. Washington 18*: 179-184.
Discusses the reports known until his epoch on the mosquito carriers of *Dermatobia* eggs. Says that in Venezuela the eggs of *Dermatobia* are laid on a plant called "guácimo cimarrón" (*Guazuma tomentosa* H. B. K.). Revises the papers by Morales, Zepeda, and corrects the error of Sambon's paper, whose figures show *Dermatobia* eggs glued lengthwise to the abdomen of a mosquito. Follows a criticism by Townsend.

137. Neiva, A. & B. Pena, 1916: Viajem cientifica pelo Norte da Bahia, sudoeste de Pernambuco, sul do Piauhí e de norte a sul de Goiaz. *Mem. Inst. Oswaldo Cruz,* Rio de Janeiro *8*: 72-224, 1 map, pls. 1-28. (Also separately printed, 1918, same pagination, Manguinhos, Rio de Janeiro).
"Entre os ectoparasitos encontrados, está a *Mydea pici* Macq. (...). Em Pernambuco e Piauhí o nome dado vulgarmente ao ectoparasito é o de *"berro";* esta designação é lidimamente vernacula, pois sob este nome designa-se em Portugal a larva cutanea da *Hypoderma* Latr. e, como até

hoje, a expressão *berne* continúa de orijem desconhecida, fato que tem despertado o interesse das pessôas que se ocuparam do assunto, não é descabida a vulgarisação do vocabulo de uso correntío no Brazil Central e donde talvez, como corrutela, se derivasse a palavra *berne*."

138. Palazzolo, G., 1916: *L'Hypoderma bovis* e la mosca *Dermatobia noxialis* o *cyaniventris* del Brasile. *Nuovo Ercolani*, Torino, *21* (26-27: 433-437.

In Brazil *Hypoderma bovis* either does not occur al all, or only very rarely. *Dermatobia hominis* is very common and its larva causes great losses. It not only infests cattle, but also horses, donkeys, mules, monkeys and even man. It is less frequently met with on hot, sunny days; it is usually found near stock. Enormous numbers of calves perish through its attack, especially when another fly, which resembles *Sarcophaga carnaria*, and is very numerous, deposits its eggs in the tumours due to *D. hominis*. The natives treat infested animals by removing the larva and pouring pure creolin into the wound, closing the orifices with dried horsedung.

139. Bishop, W. A., 1916: Two types of skin myiases. *Proc. Med. Assoc. Isthmian Canal Zone 7* (2): 87-93.

Details are given of cases of myiases caused by *Dermatobia* and *Cochliomyia macellaria*.

140. Dussel, F. F., 1917: Summary and discussion of the work performed at the Board of Health Laboratory during the Calendar year 1916. *Proc. Med. Assoc. Isthmian Canal Zone* 10 (1): 7-25.

Observations on the biology of *Dermatobia*, showing that half-grown larvae could be transplanted from one host to another.

141. D'Utra, G., 1917: Destruição do berne do gado (consulta). *Chácaras e Quintais*, São Paulo *16* (6): 504-505.

142. Baliña, P. L., 1917: A proposito de un caso de "ura" (*Dermatobia hominis*). *Prensa Méd. Argent. 2* (22): 293-295, 2 figs.

Not seen.

143. Neiva, A. & J. Florencio Gomes, 1917: Biologia da môsca do berne (*Dermatobia hominis*) observada em todas as suas fases. *Ann. Paulistas Med. Cirurg.* 8 (9): 197-209. (Reprinted in 1927: *Collectanea de Trabalhos do Instituto Butantan*, São Paulo *2*: 3-20; abstract in *Rev. Entom.*, Rio de Janeiro *11*: 65, 1940, by T. Borgmeier).

"1. — A *Dermatobia hominis* pode viver em condições artificiais, numa câmara úmida, durante 19 dias. Os casais copulam várias vêzes por dia; a primeira cópula dá-se durante as 24 horas que seguem à sua saída dos casulos. A *Dermatobia* não começa à desovar senão no 7.º dia ainda que seja posta em contacto com o macho, desde o segundo dia de sua vida de imagem. Se a aproximação sexual só se der no 15.º dia de vida adulta da fêmea, as posturas começam cêrca de 48 horas depois da cópula.

2. — A *Dermatobia* efetua as suas posturas diretamente sôbre outros dípteros. Para encontrar êsses insetos, frequenta os equídeos e os ruminantes que são assìduamente visitados por môscas silvestres e culicídeos, nos capões ou bosques e nas matas, que constituem o habitat da môsca do berne. Quando êsses dípteros se aproximam do lugar onde ela está pousada no couro do animal, ela os agarra, voa com a prêsa, e, librando no ar, deposita-lhe num lado do abdômen um cacho de ovos que se mantêm fortemente aderentes graças a um induto que os envolve, e que se solidifica ràpidamente. A *Dermatobia* pode realisar várias posturas; em cativeiro, um espécimen pôs 182 ovos, distribuídos em posturas parceladas sôbre 4 môscas domésticas.

Dois exemplares capturados sôbre cavalos no momento em que tentavam agarrar insetos, puseram 376 a 396 ovos, em 16 posturas efetuadas sôbre 3 muscídeos e sôbre as paredes do recipiente.

3. — Na América Central e na Venezuela o díptero encontrado como portador dêsses ovos tem sido apenas *Psorophora* (*Janthinosoma*) *lutzi*. Nós verificamos no Estado de São Paulo (Brasil), que *Psorophora posticatus* (= *J. musica in* Peryassú) e, muito maior número de vêzes, várias espécies

de muscídeos frequentadores de animais, também veiculam os ovos da *Dermatobia*. Os hábitos dêsses insetos permitem às larvas provenientes dêsses ovos porem-se em contacto, seguramente, com a pele de vertebrados de sangue quente.

4. — As posturas sôbre fôlhas, assim como sôbre animais, sôbre a terra, e experimentalmente sôbre o papel e as paredes de vidro do recipiente, têm a explicação seguinte : num dado momento, para a fêmea fecundada, a necessidade de realizar uma postura torna-se irreprimível; se lhe escapa então o inseto que tentou agarrar, ela desova onde pousa.

Conservadas em câmara úmida, estas posturas podem dar larvas; fora desta condição, os ovos murcham e esterilizam-se.

É muito provável que tenham ordinàriamente o mesmo fim os ovos que na natureza sejam depostos sôbre insetos.

5. — Os ovos começam a fornecer larvas cêrca de uma semana depois da postura. Estas larvas que medem 1,6 mm de comprimento, permanecem no interior do ôvo até que o díptero veiculador pouse num vertebrado de sangue quente; então elas abandonam os ovos passando à pele, onde penetram em 5 a 10 minutos. Quando o díptero veiculador se afasta do animal, as larvas que não abandonaram completamente os ovos voltam para o seu interior, fechando-se o opérculo.

Estas tentativas podem repetir-se várias vêzes diàriamente; assim podem as larvas resistir durante 20 dias sem penetrar na pele de animais. Esta penetração não depende da existência de solução de continuidade na pele.

6. — Muitos mamíferos são susceptíveis ao berne, especialmente o boi e o cão; o homem é frequentemente infestado em várias regiões do Brasil. A duração do período larval no cão é bastante variável, parecendo depender da temperatura exterior; ela foi de 31 a 34 dias numa série de experiências, e de 64 a 74 em outra. Pesando-se a larva no dia em que abandona o hospedeiro, pode-se prever o sexo do imago em que vão transformar-se. As larvas maduras de mais de 0,6 g dão fêmeas.

7. — A duração do período ninfal é também muito influenciada pela temperatura. Na estufa, a 23-25 graus ela foi de 34 dias; no laboratório, durante o inverno (12 a 18 graus por dia) durou 78 dias. O casulo que se abre por um opérculo situado lateralmente na extremidade anterior, dá o imago ordinàriamente nas horas mais quentes do dia.

8. — Nestas experiências, tôda a vida da *Dermatobia*, desde o ôvo (dia da postura) até a morte do imago, durou 120 a 141 dias. Parte da evolução dêstes espécimes deu-se durante o inverno, o que permite tomar essas cifras como a média da vida da *Dermatobia* no Estado de São Paulo."

144. Townsend, C. H. T., 1917: A synoptic revision of the Cuterebridae, with synonymic notes and the description of a new species. *Ins. Insc. Menstr. 5*: 23-28.

Key to the genera of Cuterebridae, including *Dermatobia*.

145. Wolffhügel, G., 1917: La ura, *Dermatobia hominis* (Say) [sic] pertenece a la fauna uruguaya. *Rev. Med. Vet.*, Montevideo (1917): 451-452.

Not seen.

146. Ferraris, J. B., 1917: *Dermatobia noxialis. Rev. Min. Industr.*, Montevideo *5* (32): 489-493, illus.

Not seen.

147. Dunn, L. H., 1918: The tick as a possible agent in the collocation of the eggs of *Dermatobia hominis*. *J. Parasitol. 4* (4): 154-158. (Also published in the *Proc. Med. Assoc. Isthmian Canal 11* (1): 21-25, 1918).

Amblyomma cajennense as a possible vector of *Dermatobia* eggs.

148. Lutz, A. 1917: Contribuições ao conhecimento dos Oestrideos brasileiros. *Mem. Inst. Oswaldo Cruz*, Rio de Janeiro *9*: 94-113, pls. 27-29.

Attributes the name *hominis*, erroneously, to Say. Transcribes the description of Macquart and Goudot. Cites *Grison vittatus* as host. Comments the emergence of the fly from the puparium, and doubts that eggs may be laid on vegetation. Cites some vectors of the eggs.

149. Takasugi, S., 1919: Über *Dermatobia hominis*. *Japan. Zeitschr. Dermatol. u. Urol. 19* (2): 146-147.

150. Miles Stuart, P., 1919: Nota sobre un caso de una enfermedad llamada ura. *Physis*, Buenos Aires *4*: 577.
Not seen.

151. Matta, A. A. da, 1919: Considerações sobre a dermatobiose. Notas de um estudo apresentado à Sociedade Brazileira de Sciencias. *Rev. Acad. Brasil. Sci.*, Rio de Janeiro *4* (3): 84-92, 16 figs.
Not seen.

152. Pennington, M. S., 1919: Notas sobre un caso de la enfermedad llamada "Ura" causada por larva de la *Dermatobia cyaniventris* Macq. *Physis*, Buenos Aires *4* (18): 557-578, 2 figs.
Note on a case of myiasis in an individual from Misiones.

153. Matta, A. A. da, 1920: Considerações sôbre a dermatobiose (ura ou berne) no Brasil. *Amazonas Médico*, Manaus (2) *3* (9): 2-15, 1 pl.
A review of the literature; comments on secondary infestations by *Cochliomyia macellaria*.

154. Magath, T. B., 1920: *Dermatobia hominis*. *Arch. Dermatol. & Syph.*, Chicago *2* (6): 716-721, 4 figs. (Abstract in *Trop. Dis. Bull.*, London *18* (1): 28, 1921).
The author reviews the literature on *Dermatobia;* the main objective of the paper is to antecipate the possible spread of *Dermatobia* beyond its present range.

155. Townsend, C. H. T., 1920: Nota sobre o aparelho genital das femeas de *Cuterebra* e *Dermatobia* e os seus habitos parasitarios. *Folha Medica 1* (15): 118-119.
"Recentemente tive opportunidade de dissecar uma femea de *Dermatobia hominis* L. Jr. O apparelho genital obedece ao mesmo plano que o da *Cuterebra,* mas os ovarios são verdadeiramente solidos e não achatados e enrolados, faltando também a placenta ovarica.
As ramificações tracheaes são numerosas e penetram até certo ponto na massa solida. Os ovarios, muito visinhos, lembram um utero formado por um sacco duplo. Os ovos não são incubados, sendo fecundados quando atravessam a uterovagina, por ocasião da desova.
O exemplar a que me refiro foi apanhado enquanto pousava num cavallo. A mosca não assusta o animal, mantendo-se muito quieta á espera de um hematophago que sirva de veiculador dos seus óvos. Parece-se com a *Calliphora* e tem o vôo silencioso, no que contrasta fortemente com a *Cuterebra,* que não pode deixar de assustar os animaes (...)."

156. Val Floriana, M. B. de, O. F. M. C., 1920: Diccionarios Kainjgang-Portuguez e Portuguez-Kainjgang. *Rev. Mus. Paulista 12*: 7-381.
Page 230: "Berne — *kturn, kitúdn* — 1 — *Ix kitúdn*: o berne que está em mim. — *ix*, meu. Especie de berne: *bikurú, bekurú.*

157. Chanal, L., 1921: *Rôle pathogène des Moustiques en pathologie humaine et comparée,* 91 pp., Laboratoire de Parasitologie de La Faculté de Médécine, Paris.
Ocular and other kinds of myiases caused by *Dermatobia.*

158. Fischer, H. C., 1922: Entomological Report. *Rept. Health Dept. Panama Canal* (1921): 59-60.
Ocular and other kinds of myiases caused by *Dermatobia.*

159. Tastevin, C., 1922: Grammatica da lingua Tupy. *Rev. Mus. Paulista 13*: 537-763.
Page 745 : "úra — Verme que se desenvolve na pelle dos mammiferos de um ovo deposto por uma mosca ou mosquito."

160. Oliveira Filho, L. de, 1922: *Combate ao berne,* 26 pp., 14 figs. Secretaria da Agricultura do Estado de São Paulo, Serviço de Publicações. (Reprinted from separate articles published in the *"Estado de São Paulo"*, September, 1921).
Experiments on oviposition, penetration into the host, under several conditions, general biology, control, etc.

161. Townsend, C. H. T., 1922: O berne e a sua eliminação *Almanack Agric. Brasil.*, São Paulo (1922): 147-158, 4 figs. (Also separately printed, same year, in the Bibliotheca Agricola Popular Brasileira, Ed. Chacaras e Quintais, São Paulo).

After a lengthy discussion on the research and general biology of the fly, the author discusses some control methods and points out 20 aspects of its life history which were not clear until his epoch.

162. Bau, A., 1922: Über die technisch-biologische Bedeutung der Oestriden, das verrirte Vorkommen, ihrer Larven, sowie über *Oestrus hominis*, *Hypoderma equi* und *alcis*. *Zeitschr. Techn. Biol. 10* (3-4): 177-193.

Not seen.

163. Peryassú, A. G., 1922: Os mosquitos portadores de ovos da mosca do berne. (Nota previa). *Folha Medica*, Rio de Janeiro *3* (14): 105.

Psorophora posticata as vector of *Dermatobia* eggs.

164. Loughman, W. F. M., 1922: Notes on a case of myiasis. *Journal R. A. M. C.*, London *38* (6): 458.

A case of myiasis by *Dermatobia* observed in British Honduras, with a discussion on the intermediate oviposition of the fly.

165. Dawe, M. T., 1922: Efwatakala grass (*Melinis minutiflora*) as a means for the control of the tsetse fly. *Tropical Life*, London *18* (5): 69-71, 1 fig.

"It is much used in South America as pastures for cattle, and it is believed that ticks cannot live in it. It is even said that cattle when fed on the grass and then removed to tick-infested pastures are not attacked by the parasites for some time. It is believed in Colombia that the fly producing warbles in cattle in South America (*Dermatobia hominis*) is disappearing before the extending cultivation of the grass, which grows easily on either moist or dry land and spreads very rapidly."

166. Townsend, C. H. T., 1923: Analyse do ambiente de berne e resposta. *Almanack Agric. Brasil.*, São Paulo (1923): 225-231.

A feeble tentative to analyse the ecological background of *Dermatobia*.

167. Herrera, M., 1923: *Guia para visitar la colección de los aracnideos, miriapodos e insectos, con especial indicacion de los artropodos nocivos al hombre y a la agricultura*, 200 pp., 59 pls. Secretaría de Agricultura y Fomento. Talleres Graficos de la Nación, México.

Dermatobia : pl. 27 (moyocuil).

168. Van Thiel, P. H., 1924: Over het vorkomen van der larve van *Dermatobia hominis* bij den Jaguar. *Herinnerigsb. Inst. Trop. Geneesk.*, Leiden (1924): 138-152, 1 pl., 2 figs.

A larva found in the jaguar. The variability of the larval characters is discussed and descriptions are given of the larval structures.

169. Nuñez-Tovar, M., 1924: Notas de historia natural medica. Experiencias para determinar que zancudo transmite el gusano de monte. *Bol. Cam. Comercio*, Caracas *13*: 2540.

Not seen.

170. Baldassare, T., 1924: Contributto all'ophthalmomyiasis. Loccalizzazzione palpebrale di larva di *Dermatobia cyaniventris* Macq., 1840. (Casistica, osservazione personale, cenni entomologici). *Boll. Ocul.*, Firenze 3 (7): 663-682.

Not seen.

171. Newstead, R. & W. H. Potts, 1925: Some characteristics of the first larval stages of *Dermatobia hominis* Gmelin. *Ann. Trop. Med. Parasitol. 19* (2): 247-260, pls. 4-5.

Dermatobia hominis differs from all the other Oestrids in that instead of laying eggs directly on the hair or skin of the host, it lays batches of eggs on the bodies of other insects, chiefly mosquitoes. The larva does not apparently emerge until the mosquitoes alight on a warm-blooded animal. If it is unable to emerge completely during the time the mosquito is feeding, it will withdraw into the egg until the mosquito alights on another warm-blooded animal. This may occur several times, the larvae being able to

remain alive for 20 days before reaching a host. Recent work on the life-history is reviewed and various morphological characteristics are discussed. A list is given of the insects found with the eggs of *Dermatobia*, both under natural and experimental conditions, and of the countries where they were found.

172. Wille, J., 1925: Übersicht der landwirtschaftlich wichtigen Isekten von Rio Grande do Sul (Brasilien). *Zeitschr. angew. Entom. 11* (3): 415-426.

This list of 265 species includes *Dermatobia* infesting horses, cattle, dogs and other domestic animals.

173. Shannon, R. C., 1925: Brief history of the egg-laying habit of *Dermatobia hominis*. *J. Washington Acad. Sci. 15*: 137.

Dermatobia attacks many warm-blooded animals, including man. It lays its eggs, usually 8-10, on the lower surface of the abdomen of blood sucking mosquitoes. The larvae hatch while the mosquito feeds, and burrow under the skin of their future host. In almost all cases observed, it was *Psorophora* (*Janthinosoma*) *lutzi* the mosquito carrier, although the author has found a batch of eggs on a non-blood-sucking mosquito, *Goeldia longipes*, in Panama.

174. Castellani, A., 1925: Observations on some diseases of Central America. *J. Trop. Med. Hyg. 27* (1): 1-14, 19 figs., 1 pl.

Myiasis due to *Dermatobia; Janthinosoma lutzii* as vector.

175. Ribeiro, R., 1926: O berne. *Correio Agric. 4* (9): 257-260.

In the Brazilian State of Bahia cattle are infested, sometimes with fatal results, by the larvae of *Dermatobia hominis*, especially in rainy years. The larvae are unable to burrow into hard ground for pupation and die in a few hours, whereas they burrow readily in moist, loose soil. The pupal stages last 20-30 days. Eggs are laid on the leaves of bushes or directly on the cattle or may be attached to, and carried to the cattle by mosquitoes or other flies. It is possible that *Dermatobia hominis* may sometimes be viviparous [sic], depositing larvae directly on the host. Animals with bright-coloured coats are not infested to the same degree as those with dark coats. The measures to be taken include removal of the larvae, the dressing of the wound with an ointment containing creolin, and the use of the usual tick dips.

176. Shannon, R. C. & C. T. Greene, 1926: A bot-fly parasite of monkeys. *Zoopathologica*, New York *1* (7): 287-290, pls., 2 figs.

Of the five genera of Cuterebridae which are apparently peculiar to America (*Dermatobia, Pseudogametes, Rogenhofera, Cuterebra* and *Bogeria*), *Dermatobia* parasitizes man, monkeys, dogs, cattle and birds, but the others (except for *Rogenhofera*, the habits of which are unknown) seem to confine themselves to rodents and opossums; the flies may occasionally infest other hosts such as cats, dogs and pigs, but these cases are accidental.

177. Bertoni, M. S., 1926: *La civilización guarani. III. Conocimientos. La higiene guarani y su importancia cientifica y practica. La medicina guarani. Conocimientos cientificos.*

"Una de las molestias más generales en la parte caliente y húmeda de ambas Américas es seguramente la *Ura* (*Dermatobia hominis*), o mejor dicho, la larva de esta mosca, distinguida del animal perfecto con el nombre de *Mberuaró*, siendo ambos nombres guaraníes. Llama la atención que G. Piso y Marcgrave no hablen de este insecto. La primeira noticia, muy concisa pero exacta, la dió el celebre viajero francés La Condamine, que la recogiera de los rivereños indígenas del Amazonas. De su relación, dedujo Linneo la indicación que hizo, en 1789 [sic] de que se trataba de una mosca, la que ponía huevos o larvas vivas, sobre la piel de los animales, donde la larva pronto se introduzia, para alli desarrollarse, y a los seis meses caer para formarse el insecto alado. Todas esas primeras noticias, de fuente india, eran pues exactas. Los guaraníes conocian perfectamente el origen y lo esencial de la biología de la Ura."

178. Navarro de Andrade, E., 1927: Pesquisas sobre o berne, sua frequencia no homem, nos bovinos, suinos e equideos, e da applicação de um novo methodo de provavel efficiencia para o seu combate. *Bol. Biol.*, São Paulo *6* : 25-31.
Not seen.

179. Campos, E., 1927: Berne palpebral, *in Consultas ophthalmologicas para o medico polyclinico*, Rio de Janeiro.
Not seen.

180. Cerqueira Falcão, E. de, 1927: Myiase palpebral determinada pela *Dermatobia cyaniventris* Macq., 1840. *Brasil-Medico*, Rio de Janeiro *41* (40) : 1038-1042.
Several cases of myiasis in the eylid are reported.

181. Ramos, J. D., 1927: Reparos à terapeutica de myiase palpebral e orbitaria pelo berne. *Bol. Soc. Med. Cirurg. Rio Preto 2.* (Reprinted in 1928, in the *Semana Ophthalmologica*, São Paulo).
Not seen.

182. Alencar, M. de, 1928: Das myiases oculares no homem. Do berne — como extrail-o. *Ceará Medico 7* (4): 5-8.
Cites three cases of ophthalmomyiasis, and a surgical method for the extraction of larvae located in the eyelid.

183. Sarmento Filho, D., 1928: O berne. *Bol. Agric. Zootechn. Veter. 1* (12): 73-89, 4 figs.

184. Cerqueira Falcão, E. de, 1929: Considerações acerca das ophthalmomyiases determinadas pela *Dermatobia cyaniventris* Macquart, 1840. *Brasil-Medico*, Rio de Janeiro *43* (38): 1134-1138.
Not seen.

185. Souza Lima, S. S., 1929: Considerações em torno de um caso de berne palpebral. *Brasil-Medico 21.*
Not seen.

186. Campos, E., 1929: Ainda a propósito de bernes palpebraes. *Brasil-Medico*, Rio de Janeiro *24.*
Not seen.

187. Martins, A., 1929: Berne ocular — myiase nasal. *Brasil-Medico*, Rio de Janeiro *26.*

188. Navarro de Andrade, E., 1929: Pesquisas sôbre o berne. *Arch. Inst. Biol. São Paulo 2*: 53-60. (Reprinted in *O Campo*, Rio de Janeiro *1* (1): 56, 1930).
In an effort to prevent fires in a plantation of *Eucalyptus* consisting of 8,500 ha. (20,987 acres), cattle were employed to destroy the undergrowth. The presence of the cattle, however, proved serious, because *Dermatobia* multiplied on such a scale, that, after heavily infesting all of the 650 bovines, it attacked all the domestic animals and man himself to an unprecedented manner (10.9% in 1927). After the cattle were removed, infestation of the equines fell to 5.2% in 1929. Among the equines, the mule was the most affected. The parasites generally attack the neck.
Among the 363 persons infested in a total of 819 residents in proximity to the plantations, the infestation was very intense, as 100 bots were observed in the back of an individual, 86 in that of a second and 72 in that of a third. In the man, 43% of the parasites were located in the back.
In the women, the back and the lower limbs were equally attacked, 35% on each. In the children, however, *Dermatobia* showed equal preference for the head and back, 33.9% on each. Attack on the head was not observed in adults. Apparently the individuals of the white race are most severely attacked.

189. Ihering, R. von, 1929: Os oestrideos importados, seu papel como parasitas e em particular os *Gastrophilus* no Brasil. *Bol. Agric.*, São Paulo *30*: 863-883. (Also published in *O Campo*, Rio de Janeiro *1* (6): 62-67, 10 figs., 1930).
Of various Oestrids harmful to mammals *Dermatobia hominis* is indigenous in Brazil. *Gasterophilus nasalis* L. which infests horses, is the only

exotic species known to be established in that country. Animals are aprehensive of infestation by Oestrids and endeavour to escape their attacks, and it is suggested that this is why *D. hominis* no longer oviposits directly on its host but has its eggs carried by other Diptera [sic].

190. Dunn, L. H., 1929: Notes on some insects and other Arthropods affecting man and animals in Colombia. *Amer. J. Trop. Med. 9* (6): 493-508.

During a campaign against yellow fever in Colombia, in 1923-24, a collection was made of the more common noxious Arthropods observed, of which an annotated list is given, which includes *Dermatobia hominis*.

191. Ferrari, A. 1929: Considerações sobre a ophthalmomyiasis determinada pela *Dermatobia cyaniventris* Macquart, 1840. *Brasil-Medico*, Rio de Janeiro *43* (47): 1428.

Not seen.

192. Ribeiro da Fonseca, O. O., 1929: Diario de uma viagem ao oriente da Bolivia, de Porto Esperança a San José de Iquitos. *Mem. Inst. Oswaldo Cruz*, Rio de Janeiro *22*: 175-222, pls. 52-108.

Cites the name "borro" (p. 200; as "bôro").

193. Dunn, L. H., 1930: Rearing the larva of *Dermatobia hominis* Linn. in man. *Psyche*, Cambridge *37*: 327-342, 1 fig., pl. 13.

The author's objective was to present "some observations on the development of the larvae of *Dermatobia hominis* when reared in man and on the effects of an infestation of these larvae upon the host."

Dunn was infested with 6 larvae — two experimentally introduced in his left arm, and 4 which were accidentally contracted. He describes with much detail and precision the penetration of the larvae, the symptoms caused, etc. He was able to rear all six larvae in his body until their emergence for pupation.

The parasitic larvae took from 46-47 days from the penetration into the skin to the emergence from it. The larvae thus obtained were maintained in damp sand, where they pupated and gave adult flies. Pupation periods took 22-24 days.

Dunn is the only author, as it seems, who has been able, although incompletely, to observe molting in *Dermatobia* larvae. Larvae have penetrated his skin at October 9; he thinks that the first molting has occurred at October 21; the second molt at November 8, comprovated by the cast skin adherent to the bandage put over the wound; the larvae have finally emerged at November 25. This gives 12 days from penetration into the skin to first molting, 18 days between the two moltings, and more or less 18 days between second molt and emergence from the skin. This means a total of approximately 70 days from penetration into the skin to the emergence of the adults.

194. Neiva, A. & J. Florencio Gomes, 1930: El gusano de monte. *Rev. Agric. Puerto Rico*, San José *24*: 99-106, 123.

Spanish abridgement of their paper published in 1917.

195. Pinto, C., 1930: *Tratado de Parasitologia. Arthropodes parasitos e transmissores de doenças 2*: 397-845, figs. 191-356, pls. 8-36. Biblioteca Scientifica Brasileira, Collecção Medico-Cirurgica, n. 177a. Typ. Pimenta de Mello & Cia., Rio de Janeiro.

Dermatobia: pp. 451-468. Good résumé of biology and list of vectors.

196. Pinto, C. & F. D. R. da Fonseca, 1930: Novo genero e nova especie de mosca hematophaga da sub-familia Stomoxydinae, hospedadora intermediaria da *Dermatobia hominis*. *Rev. Med. Cirurg. 38* (7): 241-247, 1 fig., 3 pls.

Description of *Neivamyia lutzi*, vector of *Dermatobia* eggs.

197. Pinto, C. & F. D. R. da Fonseca, 1930: Novos hospedadores intermediarios da *Dermatobia hominis* (L. Junior, 1781) (Diptera, Oestridae). *Rev. Med. Cirurg. 38* (7): 247-250, 1 pl.

List of vectors (see section 7.4).

198. Calzada, V., 1930: Miasis subcutánea forunculosa por larvas de *Dermatobia*. *Bol. Mens. Pol. Sanit. Animal 6*: 606-616.

Not seen.

199. Mazza, S. & M. de los Rios, 1931: Primera comprobación de miasis cutánea por *Dermatobia hominis* en Jujuy. *7. Reunión Soc. Argent. Patol. Reg.* (Tucumán, 5-7 Oct. 1931) *2*: 787-796, 8 figs.

Not seen.

200. Günther, K., 1931: *A naturalist in Brazil. The Flora and Fauna and the people of Brazil*, 400 pp., illus. G. Allen & Unwin Ltd., London.

Dermatobia : p. 350.

201. Rehaag, H., 1931: Os bernes. *Bol. Agric. Zootechn. Veter. 4*: 49-56, 4 figs.

202. Townsend, C. H. T., 1931: Notes on American Oestromuscoid types. *Rev. Entom.*, Rio de Janeiro *1*: 65-104.

Page 80: "*Oestrus hominis* Linn. Jun. Ht?. Propleura pilose; prosternum black-and-yellow bristled on disc, its membrane inflated and bristled; postalar wall bristled posteriorly and on upper edge in middle, tympanic ridge long-pale-pilose, but pit bare; greater ampulla ovoreniform, large and raised. *Dermatobia hominis* Linn. Jun. (gt)."

203. Travassos, L., 1931: Algumas observações sobre a *Dermatobia hominis* (L. J., 1781) (Diptera: Oestridae). *Bol. Biol.*, São Paulo *18*: 35-38, 4 figs.

Page 36: "Os órgãos machos são constituídos pelas seguintes partes: fórcipes, placas acessórias, um par de *claspers* e o pênis (seguimos aqui a terminologia de Aldrich para Sarcophagas). Os fórcipes são muito reduzidos, pilosos e apresentam pontas cônicas dirigidas de trás para diante, porém pouco salientes; vistos de face apresentam contôrno subtriangular e são separados por uma fosseta rica em pubescência disposta em várias direções. As placas acessórias são curvas, de concavidade interna e apresentam pêlos esparsos; não são mais salientes que os fórcipes. Os claspers têm origem na base do pênis e se dirigem de diante para trás, são cônicos, divergentes e ficam situados por dentro das placas acessórias. O pênis é relativamente volumoso e curvado em arco de concavidade posterior, é comprimido lateralmente, tendo a parte distal dilatada, de côr escura quase negra e guarnescida ventralmente de numerosos espinhos escamiformes e recurrentes. Os fórcipes medem cêrca de 0,45 mm de comprimento por 0,22 mm de largura máxima; as placas acessórias têm um comprimento de cêrca de 0,40 mm por uma largura de 0,18 mm; os *claspers* medem cêrca de 0,35 mm de comprimento; o pênis mede cêrca de 0,80 mm de comprimento por uma largura de cêrca de 0,18 mm visto de face e 0,15 mm, visto de perfil, tendo a parte distal, dilatada, um diâmetro de cêrca de 0,22 mm."

204. Primio, R. di, 1932: Algumas considerações sobre a *Dermatobia hominis* (Linneu Jr., 1781), no Rio Grande do Sul. *Arq. Riograd. Med. 11* (7).

Not seen.

205. Bequaert, J., 1938: Contribution to the entomology of Yucatan, in the Peninsula of Yucatan, Medical, Biological, Meteorological and Social Studies. *Carnegie Inst. Washington Publ.* 431: 547-576.

Dermatobia — p. 565. Bequaert does not admit the synonymy between *Dermatobia hominis* and *Oestrus hominis* Gmelin, saying that no basis exists to prove that both names refer to the same species. Discusses the geographical distribution of *Dermatobia*, commenting on its occurrence near Tampico, Mexico. Does not believe that the species may occur in the United States.

206. Lins de Almeida, J., 1933: Nouveaux agents de transmission de la berne (*Dermatobia hominis* L. Junior, 1781), au Brésil. *C. R. Soc. Biol. Paris 113:* 1274-1275.

List of vectors (see section 7.4).

207. Cerqueira Falcão, E. de, 1933: Rino-míase por *Dermatobia cyaniventris* (Macquart). *Rev. Otolaring.*, São Paulo *1* (6): 461-463.

Not seen.

208. Dunn, L. H., 1934: Prevalence and importance of the tropical warble fly, *Dermatobia hominis* Linn., in Panama. *J. Parasitol.*, Baltimore *20* (4): 219-226.

Military records of early exploration in Panama show that *D. hominis* has been prevalent for many years. A case of cerebral myiasis is reported, in which the autopsy on a child 1½ years old revealed a large larva of *D. hominis*. The author captured on his leg a fly carrying eggs of *Dermatobia* and later discovered that two larvae had penetrated his khaki drill breeches to reach the skin, where they began development. The fly causes a great loss in cattle and is also found on sheeps, dogs, rabbits, monkeys and agoutis.

209. Dunn, L. H., 1934: Entomological investigations in Chiriqui Region of Panama. *Psyche*, Cambridge *41* (3): 166-183.

A study of animal parasites and blood sucking insects. *Dermatobia hominis* larvae were found on 2 coatis (*Nasua narica panamensis*) and *Cuterebra baeri* larvae on howling monkeys (*Alouatta palliata inconsonans*).

210. Patton, W. S., 1935: Studies of the higher Diptera of medical and veterinary importance. A revision of the genus *Glossina* Wiedemann based on a comparative study of the male and female terminalia. *Ann. Trop. Med. Parasitol. 29* (4): 483-496, 11 figs.

The author describes the terminalia of *D. hominis, Cuterebra fontinella, C. approximata, C. americana, C. atrox* and two undetermined species of *Cuterebra* (*Borgeria*). Describes their salient characters and discusses the relations of the species and genera.

211. Picado, C., 1935: Sur le principe bactéricide des larves des mouches. *Bull. Biol.*, Paris *69* (4): 409-438, 3 figs.

The author discusses the methods of feeding of various Dipterous larvae, with particular reference to that of maggots used in the treatment of wounds.

Filtrates obtained from the crushed intestine or body walls of *Dermatobia hominis* showed bactericidal action on *Staphylococcus* from man or cattle, but not on bacilli isolated from the intestine of the larva.

212. Patton, W. S., 1935: Classification of the myiasis producing Diptera of man and animals, *in* Parasites, transmetteurs, animaux venimeux. *Rec. Travaux 25e Anniv. Sci. Pavlovsky* (*1909-1934*): 269-271, Moscow. (Russian Abstract).

The author divides the Diptera that cause myiasis in three main groups, of which the first comprises species that normally or always develop in living tissues of man and animals; the second, species that normally breed in decaying animal or vegetable matter but sometimes infest wounds or even uninjured surface tissue, and the third, species that may cause myiasis of the digestive tract if the eggs or larvae are accidentally swallowed with food.

The first group is further subdivided into flies such as *Cordilobia anthropophaga* Grünb. or *Dermatobia hominis* which do not oviposit on the host, those that deposit eggs or larvae in or near the tissues that the larvae infest and such flies as Oestridae, which deposit or larviposit on special parts of the body of the host, so that the larvae subsequently gain acess to particular tissues or organs, on which alone they can attain full growth.

213. Araujo Pontes, H. de, 1935: *O berne, sua descrição, historia, desenvolvimento, meios de combate, etc.*, 24 pp., Prata, Minas Gerais.

214. Townsend, C. H. T., 1935: *Manual of Myiology*, Part II: 280 pp., 9 pls., C. Townsend & Filhos, Itaquaquecetuba.

Dermatobia pp. 228-233. (See chapters 5, 7.3).

215. Chaves, A., 1936: No plano economico de sua propagação a berneira transforma outras moscas em "amas secas" de sua prole. *Bol. Agric. Zootechn. Veter. 9* (3): 177-179, 1 fig.

216. Lane, J., 1936: Notas sobre mosquitos de São Paulo. *Bol. Inst. Hyg. São Paulo 60*: 3-15, 14 figs.

Three new vectors of *Dermatobia* eggs (see section 7.4).

217. Ballou, C. H., 1936: El tórsalo. *Rev. Centro Nac. Agric. 1* (1-2): 24-25.

218. Gonzalez-Rincones, R., 1936: Acerca de los progresos en el estudio de la *Dermatobia cyaniventris*. *Rev. Chil. Hist. Nat. 40*: 54-56.

219. Mazza, S. & A. J. Señorans, 1936: Miasis forunculosa por *Dermatobia hominis* en el Chaco. *Reun. Soc. Patol. Reg. Norte* (Santiago del Estero, 1933) *2*: 479-481, 2 figs., Buenos Aires.
Not seen.

220. Fróes, A. P., 1936: Sobre a multiplicidade dos veiculadores da *Dermatobia hominis*, "mosca do berne". *Rev. Med. Bahia 4* (3): 52-58.
List of vectors of *Dermatobia* eggs (see section 7.4).

221. Price, A. S., 1937: The warble-fly *Dermatobia hominis* Linn. Report of two cases imported from Costa Rica. *New York State J. Med. 37* (13): 1503-1505.
Two cases were observed : one in the eyelid and the other in the thigh. The larvae were killed with ethyl chloride and then extracted with a forceps.

222. Bequaert, J. C., 1938: Notes on the Arthropoda of medical importance in Guatemala. *Carnegie Inst. Washington Publ. 499*: 223-228.
Page 277: Larvae of *Dermatobia* are frequently seen attacking wild and domestic animals and man. It is called "beef-worm". One was found in a jaguar (*Felis onca goldmani*) and other in an armadillo (*Dasypus novemcinctus mexicanus*).

223. Gallo, P., 1938: Importantes datos sobre el tórsalo. *La Prensa*, Managua, February 19, 1938: 2, fig. 2.
Not seen.

224. Carvalho, G. T. de, 1938: Combate aos carrapatos e ao berne (Notas e informações). *O Biológico*, São Paulo *4* (2): 46.

225. Pinto, C. & H. S. Lopes, 1938: *Zoo-parasitos de interesse medico e veterinario*, 376 pp., 106 pls., 162 figs., 1 map.
Dermatobia: pp. 111-113.

226. Townsend, C. H. T., 1938: *Manual of Myiology*, Part VI, 234 pp., C. Townsend & Filhos, Itaquaquecetuba.
Dermatobia: pp. 177-178 (see section 4.1).

227. Lopes, H. S., 1938: Sur quelques diptères porteurs d'oeufs de la *Dermatobia hominis* L. Jr. au Brésil (Dipt. Oestridae). *C. R. Soc. Biol. Paris 129*: 427.
Not seen.

228. Peña Ch., A. & H. W. Kumm, 1939: Algunas consideraciones generales sobre la miasis cutánea (tórsalo) en Costa Rica. *Rev. Méd.*, San José *3* (64): 635-641, 4 figs.
Not seen.

229. Mollica, J., 1939: Berne e myiases. *Brasil-Medico*, Rio de Janeiro *53*: 713-716.
Not seen.

230. Rezende, C. de, 1939: Berne e myiases. *Brasil-Medico*, Rio de Janeiro *53* (36): 874-875.
Not seen.

231. Viana Castillo, B., 1939: Gusano de zancudo. Un caso de localización rara en el hombre. *Rev. Policlin.*, Caracas *9*: 3183-3185.
A case of ocular myiasis due to *Dermatobia* with a technique for the extraction of the larva.

232. Curran, C. H., 1939: The human bot-fly. *Natural History*, New York *44*: 45-48, 2 figs. (Abstract in *Science Digest*, June 1940).

233. Ferrari, A., 1939: Berne e myiases. *Brasil-Medico*, Rio de Janeiro *53* (22): 793-794.
Not seen.

234. Gonzalez-Rincones, R., 1939: Esquema evolutivo de la *Dermatobia cyaniventris*. *Bol. Acad. Cienc. Exactas, Fisicas y Naturales*, Madrid *4* (18): 103-107, 1 pl.
Not seen.

235. Calzada, V., 1940: Sobre existencia de *Dermatobia hominis*. *Bol. Mens. Dir. Ganad. Uruguay 24* (4): 430-435, illus.

236. Anon., 1941: Berne. *Ceres*, Viçosa *3* (15): 167-168.

237. Carneiro, G. G. & G. Drumond, 1941: Estudo preliminar sobre o ataque do gado bovino pelo berne. *Bol. Assoc. Ex-Alunos Esc. Sup. Agric. Estado Minas Gerais*, Viçosa *3-4*: 45-46.

238. Casos, G. A., 1941: Mal de la ura. *El Campo*, Buenos Aires *25* (293): 8-10.

239. Vivas-Berthier, G., 1941: El gusano de monte, de zancudo o de mosquito. *Rev. Med. Veter. Parasitol.*, Caracas *3*: 129-152, illus.
Not seen.

240. Pittier, H., A. Peña, E. Gonzalez F., J. Gomes A. & A. Guzman, 1941: Origen del tórsalo en Costa Rica. *Rev. Agric.*, San José *13* (10): 512, (11): 560, (12): 601-602.

241. Siddons, L. B. & D. W. Roy, 1942: On the life-history of *Synthesiomyia nudiseta* Van der Wulp (Diptera, Muscidae), a myiasis producing fly. *Parasitology*, Baltimore *34*): 239-245, 19 figs.
Synthesiomyia nudiseta, reputed as causing secondary myiasis in man, as vector of *Dermatobia* eggs.

242. Manchiamelo, G. J., 1942: La ura en el territorio nacional de Misiones, N. y E. de la Provincia de Corrientes. *Bol. Tecn. N. A. N. 5*: 275-297.
Not seen.

243. Santamaria, F. J., 1942: *Diccionario general de americanismos*, Tomo III. Ed. Pedro Robredo, Mexico, D. F.
Page 203: "*TORCEL* (Tal vez de *torcer*, por lo retorcido del animal). m. Nombre vulgar que en Costa Rica se da al MOYOCUIL o COLMOYOTE, cuya larva se cría bajo la piel de ciertos animales y aun en la del hombre."
Page 206 : "*TÓRSALO*. m. En Centro América, larva en forma de gusano que se desarrolla bajo la piel de las personas y de algunos animales, produciendo hinchazón y agudos dolores. Ataca mucho al ganado vacuno en Costa Rica, causando estragos. Llámase también *torcel*. Es el *colmoyote* o *moyocuil* de Méjico y es producido por un díptero de las aestridos [sic], del género *Dermatobia*, especie de mosquito [sic]. Es fácil de expulsar, poniendo ceniza caliente en la boca de la fístula que abre, con lo cual muere y se le saca por compressión. (*Dermatobia cyaniventris; Hypoderma*, o *Aestrus* [sic] *bovis*). En Colombia se le llama *nuche* o *gusano del monte*. En español, *cuca* o *cuco*."

244. Harrell, W. B. & V. Moseley, 1942: Surgical treatment of subdermal myiasis due to *Dermatobia hominis*. *South. Med. J. 35*: 720-723.
Not seen.

245. Lima, J. P., 1942: *Como combater o berne*. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro.
Not seen.

246. Townsend, C. H. T., 1942: *Manual of Myiology*, Part XII, 342 pp., 84 pls. C. Townsend & Filhos, Itaquaquecetuba.
Relation with fossils (p. 11); control of *Dermatobia* and criticism of Curran's 1939 paper (pp. 165-169).

247. Bates, M., 1943: Mosquitoes as vectors of *Dermatobia hominis* in Eastern Colombia. *Ann. Ent. Soc. Amer. 36* (1) : 21-24.
"The adult female of *D. hominis*, when ready to lay eggs, is zoophilous in that she is attracted to warm-blooded animals; taking up a position on a man or horse, she seizes other zoophilous flies and lays her eggs on them. From observations of the oviposition behaviour and from the relative incidence of eggs on different species of mosquitoes, it would seem that the characteristics of a vector of *Dermatobia* eggs are : a) zoophilous habit; b) diurnal flying period; c) moderate size (for instance most Tabanids would be too large to handle, *Hippelates* too small); d) moderately active habits (very sluggish insects would not stimulate the pounding behaviour in *Dermatobia*, and very active ones would escape). Both *Dermatobia* and

its vectors seem to be forest insects, though *Dermatobia* will occasionally leave the forest accompanying a host. The *Dermatobia* abundance may differ strikingly from forest to forest with no obvious relation to the abundance of cattle (assumed to be the chief host) in the vicinity."

The author lists the following culicids as vectors: *Psorophora ferox, Aedes serratus, Hemagogus capricorni, Anopheles rangeli, Mansonia* spp. *Psorophora cingulata, Anopheles boliviensis, Wyeomyia* spp., *Trichoprosopon lampropus.*

248. Meyer, J. R., 1943: O alho no tratamento do berne. *O Biológico,* São Paulo *9* (7): 163-168.

Experiments on the action of powdered onion on larvae of *Dermatobia,* when directly applied.

249. Meyer, J. R., 1943: Ação direta do alho sobre o berne (*Dermatobia hominis*). *O Biológico,* São Paulo *9* (11): 379-382.

Same objective as the former paper.

250. Santos, E., 1943: O berne (*Dermatobia hominis*). A sua influência na desvalorização de nossos couros. *Sítios e Fazendas,* São Paulo *8* (4): 13-15.

251. Neghme, R., A. & R. Donoso B., 1944: Miasis humana en Chile. *Rev. Med. Chile 72* (11): 973-981.

Two cases of human myiasis in Chile, due to *Dermatobia.*

252. Hecht, O., 1944: Algunas experiencias en la cría de la *Dermatobia hominis,* mosca del gusano de monte. *Mem. Min. Agric. y Cría Venezuela 1*: 310-311.

Not seen.

253. Keilin, D., 1944: Respiratory systems and respiratory adaptations in larvae and pupae of Diptera. *Parasitology 36* (1-2): 1-66, 54 figs.

Detailed work is presented on the respiration adaptation of aquatic and parasitic larvae, including those parasitic in mammals (*Dermatobia hominis, Hypoderma bovis* and *Gasterophilus intestinalis*).

254. Floch, H. & E. Abonnenc, 1944: Sur la myiase à *Dermatobia cyaniventris* en Guyane Française. Rôle vecteur de *Mansonia titillans. Publ. Inst. Pasteur Guyane Franç. 85*: 1-3, illus.

Infestation of man by *D. hominis* is frequent in French Guiana in the heart of the forests as well as on their edges. Cattle, buffalo, dogs and pigs are also attacked. It was found that the larvae could easily be removed by pressure if the opening of the cyst was first cleaned with alcohol and covered with cotton-wool soaked in collodion for a few hours. Eggs of *D. hominis* were found on on adult of *Psorophora lutzi* Theobald and on *Mansonia titillans* Wlk., which is very common locally, and one case of multiple infestation in man ocurred in a place where *P. ferox* Humboldt was so abundant that it was thought to be probably responsible for carrying the eggs.

255. Delmanto, A., 1945: Sôbre a miíase oftálmica. Tratamento de sua localização intra-orbitária. *Publ. Méd. 155*: 17.

Reports a case of *Dermatobia* larvae in the orbitary cavity of a child, giving a method of extracting it by surgery. Makes some references on the treatment with oxycyanide of mercury, which is reputed as very useful for curing those myiases.

256. Mirabelli, H. J. & R. D. Lori, 1945: La ura: su presencia en el hombre y los animales domesticos. *Campo,* Buenos Aires *29:* 78-81, illus. (Also published in *Suelo Argentino 4*: 602-604, illus. and in the *Bol. Veter. Ganad. 2* (7): 43-45, 1945).

Not seen.

257. Fiasson, R., 1945: Notes sur les parasites animaux du Haut-Apure (Venezuela). *Rev. Sci. Méd. Afrique Franç. Libre 2* (2): 125-151, 5 pls., map.

Most of this paper on parasites of animals in the State of Apure, the part of Venezuela where most stock is kept, consists of a list of Arthropods found there, supplemented in many cases with notes on their prevalence, hosts and sometimes their distribution, classification, etc. Cattle and dogs are commonly infested by *Dermatobia hominis.*

258. Anduze, P. J., 1945: Breve nota sobre miasis humana en Venezuela. *Bol. Entom. Venez. 4* (1): 37-40.

259. Squibb, R. L., 1945: Studies on the control of the Nuche fly and cattle tick. *J. Anim. Sci. 4* (3): 291-296.

An account is given of preliminary experiments carried out in Costa Rica from September to December 1944 on the use of DDT and aqueous extract of derris for the control of *Dermatobia hominis* and incidentally *Boophilus annulatus microplus*, the most serious pests of cattle in Latin America. Infestation by *D. hominis* occurs principally at intermediate altitudes in countries bordering the Caribbean sea. It renders hides useless for leather and often results in the death of the animal through cut arteries or secondary infestation. The egg stage, larval periods before and after entering the skin of the animal, pupal stage and adult life last, respectively, 4-8, 1-3, 38-48, 70-72 and 7-9 days. An extract prepared by steeping 1 lb. crushed green derris root in US gal. water for 24 hours was applied to infested cattle by hand with a rag on 29th September. The numbers of *D. hominis* in the treated animals on 26th October and 2nd November, after a week's continuous rain, represent 70 and 32% of the original number, and the number in untreated animals represent 135 and 75%. The extract had little effect on tick, but showed healing properties. A 4% solution of DDT in kerozene applied weekly or as spray at 25 cc per animal reduced the numbers of larvae of *D. hominis* by about half in two months but did not hasten healing. Three treatments killed all ticks. Spraying with about 1 US quart of the derris extract and then with 20 cc of DDT solution reduced infestation by *D. hominis* by nearly 84% and two treatments killed all ticks and had healing properties. Infestation among untreated animals increased by more than 55%. In view of these results, a single spray solution was devised, containing lg DDT powder, 14 cc kerozene, the extract from 40g chopped green derris root, 6g neutral soap and 400cc soft water. Applied at 400cc per animal as a fine spray, it grave excellent results against the fly and the tick.

260. Athanassof, N., 1946: O berne (dermatobiose dos bovinos). *Rev. Agric.*, Piracicaba *21* (5-6): 227-232.

Lists some of the vectors of *Dermatobia* eggs; suggests a repellent composed of tobacco extract, aloes, asafetida and vinegar in order to keep the vectors away. Wounds made by *Dermatobia* are attacked posteriorly by *Cochliomyia hominivorax* and *macellaria*, *Sarcophaga sternodontia*, etc.; for treament the author suggests that wounds be washed with 2% creolinated water.

261. Sales Gomes, C. E., 1946: Como se dá a infestação dos animais pelo berne e como combatê-lo. *Fôlha da Manhã*, São Paulo, February 23, 1946.

262. Goldman, L., 1946: Pyodermic myiasis in children. Observations with special reference to torsalo. *Amer. J. Dis. Children 69* (5): 280-283, 3 figs.

Patients with cutaneous myiasis were observed at San Juan de Dios in San José, Costa Rica. The pyodermic form of cutaneous myiasis is fairly common in children in the American tropics. In Costa Rica the parasite is usually the bot or warble fly, *Dermatobia hominis*. Some of the insect vectors or egg carriers are *Aedes angustivittatus* and *A. serratus*.

The lesions are found chiefly about the head and face and present indolent pustular furuncular and even carbuncular types. Whitish caps of the lesions may show movement. The lesions should be recognized early and the parasites removed to prevent extensive involvement with scarring. Breeding areas of the flies and the egg carriers should be subjected to the modern techniques for the chemical control of insects.

263. Baldus, H., 1947: Vocabulário zoológico Kaingang. *Arq. Mus. Paranaense*, Curitiba *6*: 149-160.

Page 159: *"ikitúgn* — bicho berne (*Dermatobia hominis*)."

264. Donoso B., R., 1947: Myiasis humana en Chile. Consideraciones clinicas y epidemiologicas. *Rev. Chil. Hig. Med. Prev. 9* (1): 3-60, 10 pls.

A study of 112 cases of human myiases produced by several species of flies, including *D. hominis*, is made. Several treatments, adequate to each location of the larvae, are indicated.

265. Oliveira, S. J., 1947: Informações sôbre o berne. *Bol. do Campo 3* (15): 11-12, 2 figs.

266. James, M. T., 1947: The flies that cause myases in man. *U. S. Dept. Agric. Misc. Publ. 631*: 1-175, 98 figs.

Dermatobia: pp. 100-104, figs. 47-51.

267. Camain, R. & E. Abonnec, 1948: Sur la myiase à *Dermatobia cyaniventris* en Guyane Française et rôle vecteur de *Aedes taeniorrhynchus* (Wied., 1821). *Publ. Inst. Pasteur Guyane Franç. 175.*

Not seen.

268. Calero, M. C., 1948: Cutaneous myiasis in Panama. *J. Parasitol. 34* (4): 343-344.

A survey of the literature on myiases in Panama, including *D. hominis.*

269. Laake, E. W., 1948: Livestock parasite control investigations and demonstrations in Brazil. *J. Econ. Entom. 42* (2): 276-280.

The author visited Brazil in April and May (dry season) 1948 to investigate and give demonstrations on the control of pests of dairy cattle. The work was done at three farms in the State of Rio de Janeiro and two at Minas Gerais. At least 90% of the pest seen were ticks (mostly *Boophilus annulatus microplus*) and larvae of *Dermatobia hominis*, both of which were extremely abundant, although arsenious-oxide dips were being used. They were neither killing all ticks present nor preventing immediate reinfestation, and they were without effect on *Dermatobia*. They were more injuring to the cattle. *Dermatobia* larvae reach their greatest abundance during the wet season.

The preparations tried for control comprised emulsion concentrates containing DDT or toxaphene, BHC (benzene hexachloride containing 12-13% gamma-isomer) as as wettable powder, and cubé powder containing 4.7% rotenone.

The treatments were ineffective against the deeply encysted second-stage and third-stage larvae of *Dermatobia hominis*, and the suspension used for the wash also failed to kill all the large larvae when injected into the cysts, though it apparently caused some larvae to disappear from them within a week of treatment. The toxaphene and mixtures of DDT and BHC had no effect on encysted larvae.

Incidental observations in Costa Rica, Panama and Venezuela revealed *Dermatobia* infestations in almost every herd of cattle, and relatively few animals were entirely free from them. In all these countries *Dermatobia* and *Boophilus* were by far the most serious and damaging external parasites of cattle.

270. Beltram, P. P., 1948: Ha quedado eliminado el problema del nuche; un triunfo de la química en Colombia. *Vida Rural 9*: 2-3.

Not seen.

271. Toledo, A. A. de, 1948: Notas sôbre a biologia e contrôle do berne. *O Biológico*, São Paulo *14* (11): 264-267.

Studies on the biology and control of *Dermatobia.*

272. Oliveira, S. J. de, 1949: Informações sôbre o berne. *Granja*, Pôrto Alegre *5*: 12-13, illus.

273. Bouvier, G., 1949: Luta contra o berne. *Granja*, Pôrto Alegre *5* (44): 22-23.

274. Hecht, O., 1949: La biología de la mosca *Dermatobia hominis y la de su* larva. *Mem. 2. Congr. Mexic. Med.* (Mexico, 1947): 571-578.

Not seen.

275. Monge S., J. R., 1949: Mosca tórsalo (o gusano de monte). *Rev. Agric. Com. Industr. 8* (92): 13.

276. Alves Neto, F., 1949: Toma um novo aspecto a luta contra o berne. De um modo geral está provado que o emprêgo do canfeno clorado é econômico e eficaz. *Rev. Criadores*, São Paulo *20* (6): 37-41, illus.

Not seen.

277. Oliveira, S. J., 1949: O berne. *Ciência para Todos* (Suplemento de divulgação Científica de "A Manhã", Rio de Janeiro) *1* (11): 10, 2 figs.

278. Penha, A. M. 1950: Inseticidas para combater carrapato e berne do gado (Consultas). *O Biológico*, São Paulo *16* (6): 134.

279. Dao L., L., 1950: Míasis humana en Venezuela: contribución al estudio de las míasis cutaneas a *Dermatobia hominis*. *Rev. Policlin.*, Caracas *13*: 290-310, illus.

Studies on human myiases produced by *Dermatobia*, and techniques for the extraction of larvae.

280. Toledo, A. A. de & H. F. G. Sauer, 1950: Efeito de alguns inseticidas clorados sôbre o berne. *O Biológico*, São Paulo *16* (2): 25-34, 2 figs.

"Pelos resultados dessas investigações, podemos concluir que:

a) dos quatro clorados ensaiados, o isômero gama do hexacloreto de benzeno e o Clordan técnico foram os únicos que demonstraram possuir alguma propriedade bernicida, segundo o método de aplicação experimentado;

b) aplicado externamente sôbre o berne, o isômero gama teve efeito rápido e letal, porém subletal quando administrado oral ou hipodèrmicamente no animal parasitado;

c) entre a administração oral e a via hipodérmica, o isômero gama do HCB é mais eficiente no primeiro caso;

d) o Clordan técnico aplicado externamente sôbre o berne não é letal para êle, mas seus efeitos são comparáveis ao do isômero gama quando administrado, em doses equivalentes, por via hipodérmica, ao animal;

e) quando, comparativamente, administrados de modo a serem ingeridos, por larvas de diversos dípteros, inclusive as da môsca do berne, os efeitos remotos do Clordan sôbre os adultos provenientes das larvas intoxicadas foram em geral mais acentuados e nítidos do que os do HCB;

f) os bovinos tratados por via parenteral com o HCB e o Clordan não manifestavam sintoma algum de intolerância dêsses clorados que desaconselhe a confirmação dessa modalidade de investigação."

281. Toledo, A. A. de, 1950: Contrôle do berne e das bicheiras com BHC (hexacloreto de benzeno). *O Biológico*, São Paulo *16* (7): 133-136.

The author recommends the use of a paste made up of 1 kg of oil and 1.5 kg of BHC, for killing *Dermatobia* larvae. The paste is spread over the animal's hide, and will contain, in this proportion, 3% of gamma isomer. The concentration is lethal to larvae, in all stages. A concentration of 1-2% affects only the younger stages, the others being able, although intoxicated, to perform the remaining cycle, but will give adults incapable of reproducing.

282. Giglio, H. E., A. Actis Dato & H. J. Borrone, 1950: Tumoración ilíaca por myiasis cutánea por larva de *Dermatobia hominis* (Linn.). *Rev. Assoc. Bioquim. Argent.* 15: 245-250, illus.

Not seen.

283. Alves Neto, F., 1951: Toma novo aspecto o combate ao carrapato e ao berne. *Rev. Soc. Rural Brasil. 31*: 42-44, illus.

Not seen.

284. Cevallos G., M. A., 1951: Investigación sobre el control del "gusano de monte" y "garrapatas" del ganado vacuno, mediante el uso de los insecticidas toxaphene y BHC en el litoral ecuatoriano. *Bol. Consorcio Centr. Agric. Manabí 12*: 15-20.

Not seen.

285. Vaitsman, J., 1951: Outra praga causada pelas môscas. *O Cometa* (Bol. Mens. de Pearson, S.A.), September 1951, n.° *9*.

286. Baroni, O., 1951: Combate prático e eficiente aos carrapatos e bernes do gado bovino. *Bol. do Campo 7* (38): 7-9.

287. Gnaegi, H., 1951: Metamorfosis completa del tórsalo y su control en los trópicos. *Rev. Agric. Com. Industr. 9*: 24-25.

Not seen.

288. Osimani, J. J., 1951: Brote epidermico de miasis humana forunculosa por *Dermatobia hominis* Linn. *Arch. Uruguayos Med. Cirurg. Esp. 38* (3): 119-125.

Not seen.

289. Vianna, E. V., 1951: Oftalmomíase por *Dermatobia cyaniventris* (berne). *Arq. Brasil. Oftalmol. 14* (2): 47-54.

Studies on ophthalmomyiases and technique for the extraction of larvae.

290. Toledo, A. A. de 1951: Experiências sôbre o combate ao berne por inseticidas. *O Biológico*, São Paulo *17* (7): 123-129.

"Baseados nos resultados gerais dos ensaios podemos concluir que : a) das 5 fórmulas comparadas como bernicidas, a de pó de BHC a 3% e a emulsão de Fenatox a 1%, em pé de igualdade, foram as mais eficientes; b) o resultado dos ensaios feitos com as mesmas 5 fórmulas, durante a estação chuvosa, como no 1.º ensaio também nesta, foram favoráveis aos efeitos da emulsão de Fenatox, e do BHC em pó, com ligeira diferença a favor da eficiência da emulsão; c) quando aplicados sem nenhum outro tratamento complementar, a ação do bernicida do BHC em pó com 3% de isômero gama, foi maior do que a emulsão de Fenatox a 1%; d) a ação benicida do BHC varia com o método de sua aplicação aos bovinos, porquanto, independentemente das condições meteorológicas, prevalecentes durante os ensaios, de um modo geral, êle revelou-se mais eficiente e econômico, quando aplicado por via sêca (polvilhamento) do que quando aplicado por via úmida (pulverização); e) sob o aspecto econômico, cada tratamento feito com BHC em pó, com 3% de isômero gama, fica 40% mais barato do que quando feito com Fenatox 50%, emulsionável em diluição de 1%; f) quanto ao tempo necessàriamente dispendido com o tratamento de um animal, dispende-se menos com o polvilhamento do que com a pulverização."

291. Adams, P. C., C. H. Castilho R. & Salmerón, 1952: Application of toxaphene for torsalo fly control. *Agric. Chem. 7* (12): 33-35, 119, 121, 123, 5 figs.

Several experiments were made with different concentrations of toxaphene. Several data are published on the different concentrations and their respective results.

292. Morales M., E., 1952: Inicio de la campaña contra el tórsalo (*Dermatobia hominis* L.) y las garrapatas en Costa Rica. *Suelo Rico 6* (28): 182-194, pls.

293. Swain, R. B., 1952: Smear EQ-335 to kill torsalo larvae. *J. Econ. Entom. 45* (6): 1101.

An experiment made in Nicaragua with Smear EQ-335 (3% of BHC or lindane plus 35% pine oil), for the control of *Dermatobia* maggots.

294. Toledo, A. A. de, 1952: Nocividade das chuvas no efeito dos inseticidas sôbre o berne. *O Biológico*, São Paulo *18* (4): 57-61.

"Baseados nos resultados gerais dêste e de trabalho realizado anteriormente sôbre o contrôle do berne em épocas chuvosas, concluímos que : a) de tôdas as fórmulas experimentadas, as emulsões dos inseticidas Londagan e Esso "A" foram as mais eficientes; b) aplicado em pó e em igualdade de condições, o Lindane revelou-se mais eficiente do que o BHC; c) como verificado mais uma vez, o BHC quando aplicado em pó, age letalmente sôbre o berne, mas devido à sua fraca ação residual, êle não evita que, logo após o tratamento, os animais sejam reinfestados; d) a pulverização, feita com o produto Londagan (BHC emulsionável) foi mais eficiente do que os polvilhamentos feitos com o BHC técnico; e) de um modo geral, nenhum dos produtos experimentados nas condições expostas neste trabalho, controlou o berne em nível satisfatòriamente alto; f) o produto mais indicado para o contrôle do berne, principalmente em animais mantidos em regime de campo, é a pasta bernicida à base de isômero gama de BHC : 1.º porque êle não é fàcilmente removível pelas chuvas, 2.º porque, além de eficiente, o seu baixo custo comporta a repetição semanal dos tratamentos, sem grande acréscimo de despesas."

295. Rodriguez-Gonzales, M., 1952: Furunculosis cutánea por larvas de *Dermatobia cyaniventris* (Macquart, 1840). Incidencia en perros (*Canis familiaris*).

Bol. Mens. Dir. Ganad. Uruguay 33 (2): 91-97, illus. (Reprinted in *An. Fac. Veter. Uruguay 6* (1): 113-115, 2 figs., 1954).

296. Adams, P. C., C. H. Castillo, H. Carlos, A. Salmerón & A. Rodrigo, 1952: Control del tórsalo en Nicaragua. *Bol. Assoc. Gen. Agric.* (316): 5-8. (Republished in the same year in *A Fazenda*, La Hacienda Co., Inc., New York 47 (4): 46-48, illus., and in *La Hacienda 47* (1): 54-56).
Not seen.

297. Creighton, J. T. & W. W. Neel, 1952: Biología y combate del tórsalo o nuche, *Dermatobia hominis* (L. Jr.): reseña bibliografica. *Turrialba 2* (2): 59-65, illus.
Not seen.

298. Mejía, J. M., 1952: La garrapata y el nuche sangran la economia. *Bol. Agric.*, Medellin (383): 3339-3340.

299. Pinheiro, J. V. & O. Baroni, 1953: O combate ao berne e a utilização das pastagens nos eucaliptais. *Bol. Comp. Paulista de Estradas de Ferro e Serviço Florestal 4*: 12 pp.
Not seen.

300. Moussatché, I. & S. J. de Oliveira, 1953: O problema do berne espera uma solução. Falam sôbre o importante assunto os veterinários Isaac Moussatché e Sebastião José de Oliveira. *O Mundo Agrícola 4* (2): 17-19.

301. Pinheiro, J. V. & O. Baroni, 1953: O combate ao berne nas pastagens sombreadas. *Bol. do Campo 9* (61): 37, 1 pl., 2 graphs, illus.
Not seen.

302. Folling, B. N., 1953: Torsalo puede y debe controlarse. *Rev. Agric. Com. 9*: 24-26.

303. Gonzalez-Rincones, R. & L. Guyon, 1953 : *Classificación general de los dípteros*, 234 pp., 62 figs. Universidad Central de Venezuela, Caracas.
Dermatobia: pp. 142-165. Republishes several papers by Rincones, Morales, etc.

304. Laake, E. W., 1953: Torsalo and tick control with toxaphene in Central America. *J. Econ. Entom.* 46: 454-458.
Experiments with 0.5% Texaphene emulsion, applied to the cattle at a concentration of 0.37% toxaphene as a dip, and with sprays of 0.5% solution of Bayer 21/199, for control of *Dermatobia* larvae and ticks (*Boophilus microplus*).

305. Neel, W. W., 1954: Control of human bot fly on cattle. *J. Econ. Entom. 47*: 540-541.
Experiments were conducted with sprays of 0.5% toxaphene (chlorinated terpene), 0.15% aldrin (chlorinated naphtalene derivative) and a combination of 0.5% DDT with 0.3% of gamma-isomers of BHC, with no effective results on the reduction of *Dermatobia* maggots in cattle, although there were larvae in the untreated animals.

306. Pinto Serra, O., 1954: Observações sôbre a postura de *Dermatobia hominis*. *An. Fac. Farm. Odontol. Univ. São Paulo 12*: 75-78.
Fannia heydenii as vector.

307. Dao L., L., 1954: Miasis cutánea a *Dermatobia hominis* en Venezuela. *Acta Méd. Venez. 2* (1): 4-12, illus.
Not seen.

308. Adams, P. C., C. H. Castillo, H. Carlos, A. Salmerón & A. Rodrigo, 1954: El control del tórsalo en Nicaragua. *Rev. Consorcio Centr. Agric. Manabí 16* : 52-54.
Not seen.

309. Castro Barona, H., 1954: Tórsalo o gusano de monte. *Rev. Agric. Com. Industr. 12* (15): 26-27.

310. Neel, W. W., 1954: Control of human bot fly in cattle. *J. Econ. Entom. 47* (3): 540-541.
Not seen.

311. Floch, H. & P. Fauran, 1954: *Mansonia fasciolata* (Lynch Arribálgaga, 1891), vecteur des oeufs de *Dermatobia cyaniventris* (Macquart, 1840) en Guyane Française. *Arch. Inst. Pasteur Guyane Franç. 15*: 114, illus.
Not seen.

312. Floch, H. & P. Fauran, 1954: Les vecteurs de la myiase furunculeuse en Guyane Française. *Bull. Soc. Pathol. exot.*, Paris *47* (5): 652-656, 13 figs. List of vectors.

313. Neel, W. W., O. Urbina, E. Viale & J. de Alba, 1955: Ciclo biológico del tórsalo (*Dermatobia hominis* L. Jr.) en Turrialba, Costa Rica. *Turrialba* 5 (3): 91-104, 3 figs.

"1. En un estudio de los vectores de *Dermatobia hominis* en el área de Turrialba, Costa Rica, se encontró que *Sarcopromusca arcuata* era el más importante. De capturas efectuadas con trampas cebadas con carne el 2.2% de indivíduos capturados de esta especie llevaban huevos de *D. hominis*. En trampas cebadas con terneros 4.5% de 1,810 individuos capturados de esa especie llevaban huevos de *D. hominis*. Todos los vectores observados eran hembras.

2. Sólo cuatro insectos de especies diferentes a *S. arcuata* fueron encontrados como portadores, siendo ellos de los géneros *Limnophora* y *Callitroga*. Se hace notable que muchas especies encontradas como vectores por otros autores, en otras áreas, aunque fueran capturadas en Turrialba, nunca llevaban huevos de *D. hominis*.

3. Se estudió la pupación bajo diferentes circunstancias. Cuando las siembras de larvas se hicieron en cajas al ras del suelo, el período pupal fué de 29.6 días con un rango de 27 a 35 días. En siembras efectuadas en cajas dentro de un edificio, en arena, el período pupal mostró una tendencia a variar según el mes en que se efectuaba la siembra, con modales de 43 días para Enero y Febrero, 37 para Marzo y 34 para Abril y Mayo. En otro experimento con control sobre la clase de suelo, la humedad y la sombra, se encontró que en suelos completamente secos de 64 larvas sembradas sólo dos puparon con éxito. En los suelos húmedos 26 moscas brotaron de 64 larvas sembradas. En estos suelos húmedos, ni el tipo de suelo, ni la presencia o ausencia de sombra tuvieron influencia sobre el éxito de la pupación. El promedio de la profundidad de la cámara pupal fué de 4.8 cm, siendo significativamente más profundas las cámaras en suelos expuestos al sol que en suelos a la sombra.

4. De 171 moscas adultas en las cuales se observó la oviposición, la longitud modal de vida fué de 14 días. La mosca domestica, encerrada en jaulas con adultos de *D. hominis* solo fue utilizada como vector en un 2% de la población. La oviposición no ocurrió sobre garrapatas ni mosquitos encerrados en las jaulas, pero sí en una *Stomoxys*. El promedio de huevos encontrados en las moscas domesticas fué de 40-45 con un rango de 20 a 75."

314. Morales M., E., 1955: El "gusano de monte" o "tórsalo" (*Dermatobia hominis* (Lin. Jr), una terrible plaga en el ganado de Costa Rica. *An. 2. Congr. Panamer. Med. Veter.* (São Paulo, Abril de 1954): 257.

315. Neel, W. W., O. Urbina, J. R. Havis & J. de Alba, 1955: Combate del tórsalo (*Dermatobia hominis* L. Jr.) por medio de insecticidas, en Turrialba, Costa Rica. *Turrialba* 5 (4): 139-146, 6 figs. (Also separately published, same pagination).

"Se informa sobre una serie de experimentos en que se probaron diferentes inseticidas clorinados como agentes reductores de la incidencia de *Dermatobia hominis* (Linn. Jr. 1781) en el ganado bovino.

En algunas pruebas preliminares, se encontró que las medidas de control de *D. hominis* se prestaban a serios errores cuando tanto los animales testigos como los tratados eran alojados en el mismo potrero, debido a la reducción total del insecto en toda el área. También se encontró que pruebas del valor de los insecticidas necessitaban abarcar tanto épocas de alta como de baja infestación ya que la efectividad de los insecticidas varía mucho según que la población de *D. hominis* esté en aumento o descenso. En ninguno de los experimentos realizados se obtuvo un control absoluto del insecto al hacer asperciones sobre ganado bovino.

No se encontró diferencia significativa entre los siguientes insecticidas al ser probados en asperciones efectuadas cada dos semanas sobre 10 bovinos por insecticidas y en los meses de mayor infestación en Turrialba; toxafeno al 0.5%, DDT al 0.5% con 0.03% de isomero gama de BHC, polvos humedecibles, y Aldrin al 0.15%. Las reduciones en números de *D. hominis* con respecto a la infestación de un grupo testigo fueron respectivamente las siguientes:

Testigo : 27.78% de larvas en cada animal después del período de tratamiento.
Toxafeno 0.5% : 14.45%.
DDT 0.5% y BHC 0.03% : 18.08%.
Aldrín : 14.84%.

En un experimento de larga duración utilizando un solo insecticida (toxafeno) en diferentes concentraciones (0.35%-0.5% y 0.75%) y diferentes intervalos entre asperciones (dos y tres semanas) se concluyó que : 1) El grado de efectividad de las asperciones varía no solo de estación a estación, sino de año en año. 2) La combinación de 0.35% de toxafeno cada dos semanas resultó ser tan efectiva como la de 0.5% con la misma frecuencia durante las épocas de baja incidencia del insecto, pero en épocas de alta incidencia, la segunda combinación resultó ser significativamente más efectiva. 3) Toxafeno al 0.75% cada tres semanas no aumentó la efectividad de control sobre las concentraciones más bajas usadas cada dos semanas. 4) La efectividad de los tratamientos se vió claramente afectada por diferencias entre los potreros y entre la resistencia natural de los animales bajo prueba. Los animales testigos mantuvieron también mayor infestación en un potrero que en otro y sin embargo algunos individuos dieron constantemente evidencia de baja infestación, debida a resistencia natural.

Usando la concentración de toxafeno al 0.5% cada dos semanas que había dado relativo éxito en Ganado Santa Gertrudis, se obtuvo un control similar en ganado Brangus.

Estudiando el poder residual del toxafeno por medio de bioanálisis de muestras de pelos de animales tratados, se comprobó que después de 14 días de efectuada una aspersión, el pelo del ganado estaba prácticamente desprovisto de concentraciones efectivas del insecticida.

Agregando adherentes P.E.P.S. al toxafeno al 0.5% y efectuando baños cada tres semanas, se obtuvo una reducción de tórsalos significativamente superior a la lograda con el insecticida de fórmula comercial."

316. Dalmat, H. T., 1955: Cutaneous myiasis of the scalp due to *Dermatobia hominis* (L. Jr.) (Diptera, Cuterebridae). *Amer. J. Trop. Med. Hyg. 4* (2): 335.

"Report is given of a case of cutaneous myiasis of the scalp due to the Neotropical botfly, *Dermatobia hominis* (Linnaeus Jr.) in Guatemala. An incision had to be made to enlarge the opening of the boil-like nodule before the larva could be removed."

317. Areba Blanco, J. de, 1955: El gusano de monte, azote de nuestra granadería. *Agric. Venez. 19*: 34-37, illus.

318. Suárez, J. G. & I. Tagle V., 1956: Myiasis por *Dermatobia cyaniventris* (Macquart, 1840) en caballos chilenos llevados al extranjero. *Bol. Chil. Parasitol. 19* (4): 77-78.

Not seen.

319. Carrera, M., 1956: O berne e seu combate. *Chácaras e Quintais*, São Paulo *94* (1): 68-70, 1 fig.

Not seen.

320. Forero, G. L., 1956: El género *Cryptolucilia* sp., nuevo huésped vector de la *Dermatobia cyaniventris* en Colombia. *Rev. Fac. Med. Veter. Zootecn. Bogotá 21*: 445-448, 1 fig.

Not seen.

321. Braaksma, H. E., 1956: De Muskietenworm een bijzondere Vorm van Myiasis. *Nederl. Mil. Geneesk. Tijdschr. 9* (3): 65-71.
Not seen.

322. Zeledén, R., 1956: Anotaciones sobre una curiosa oviposición de la mosca del tórsalo en condiciones experimentales (Diptera: Cuterebridae). *Rev. Biol. Trop.*, San José *4* (2): 179-185, 1 pl.
Author's abstract : "Among 9 specimens of *D. hominis* (L. Jr.) born in the laboratory, an interesting oviposition was observed, probably originating from a single female. Three of the egg-layings were deposited on a piece of a dry vegetable, with a total of 96 eggs; at least two more layings were observed on the abdomen and head of *Dermatobia*, with a total of 74 eggs, and 8 additional eggs on the abdomen of another female *Dermatobia*.
A comment on the possibility of warble fly transmission starting from eggs fortitiously deposited by this Cuterebrid on fixed objects is made."

323. Belavsky, E. & I. H. Hrebieck, 1956: How berne and carrapatos damage raw hides. *Leather Trade's Rev. 120*: 331-332, illus.
Not seen.

324. Morales M., E., 1956: Algunas observaciones sobre el control del tórsalo en Costa Rica. *Proc. Tenth Intern. Congr. Entom.*, Montreal *3*: 17-25, 3 figs.
Author's abstract : "The tórsalo, *Dermatobia hominis* (L.), is one of the most important pests affecting cattle in Costa Rica. Little is known about its origin in the country. Its distribution has been noted from 0 to 1200 meters above sea level, and it prefers wooden or damp areas with higher gradation in the northern part of the Alajuela and Limón provinces. From 30 to 35% of all skins produced are damaged. One-third of all cattle are either infested or in the infested zones. Control tests have been conducted using chlordane in concentrations of 0.5%, 1%, 3% and 4% (suspension). Best time for application — two weeks during rainy season and three weeks during dry season. The smaller concentration is the best. No signs of intoxication. Toxaphene, emulsifiable and wettable powders, and lindane wettable powder were tested as sprays as well as by imersions using wettable powders of both. Lindane was used as a smear at 3%. All gave promising results. To obtain effective control, pasture and grazing land must be kept free of weeds, especially tall weeds. Insecticides of long residual effect must be used in stables to control the adults. A campaign conducted throughout the country, using all available resources, could bring this pest under control."

325. Greene, C. T., 1956: Dipterous larvae parasitic on animals and man and some dipterous larvae causing myiasis in man. *Trans. Amer. Ent. Soc. Philad. 82* (1): 17-34, 21 figs.
Describes a *Dermatobia* larva, from Nicaragua.

326. Muñoz-Rivas, G., 1956: Notas sobre *Dermatobia hominis*. *Rev. Fac. Med. Veter. Zootecn. Bogotá 21*: 528-535, illus.
Not seen.

327. Ruiz Martinez, C., 1956: Las gusaneras del ganado y su control. *Revista Pecuaria*, Caracas *24* (247): 24.
Not seen.

328. Ruiz Martines, C., 1956: Experimentos para el combate por meio de insecticidas del gusano de monte o tórsalo. *Revista Pecuaria*, Caracas *24* (255): 17.
Not seen.

329. Ruiz Martinez, C., 1956: Perjuicios que causa el "nuche" en el ganado vacuno. *Revista "Wimco"*, Caracas *3* (26).
Not seen.

330. Ruiz Martinez, C., 1956: El gusano de monte y su combate. *Revista Pecuaria*, Caracas *24* (249): 17.
Not seen.

331. Briceño-Maaz, T., 1957: Eu gusano zancudo. *Campo*, Maracaibo *42*: 9-11, illus.
Not seen.

332. Zeledón, R., 1957: Algunas observaciones sobre la biología de la *Dermatobia hominis* (L. Jr.) y el problema del tórsalo en Costa Rica. *Rev. Biol. Trop.*, San José 5 (1): 63-75.

Author's abstract : "Some biological aspects are studied of the human bot fly *Dermatobia hominis*, which attains rather large proportions in Costa Rica. In some areas where the bot is abundant, the stable-fly *Stomoxys calcitrans* acts in a rather high percentage as the carrier for the eggs. Since *Stomoxys* is present with fair regularity in human dwellings carrying *Dermatobia* eggs, it is easy to understand that measures taken to control the former may serve to decrease the incidence of the latter on animals and man.

Several experiments are described on pupation of the mature larva in which various materials were used — damp soil, dry soil, wood shavings, excelsior, and blotting paper in the bottom of the flasks. Although the experiments were made in small scale, they have some significance in that they tend to show no appreciable differences in the larvae's ability to pupate and their viability in the various media. The substrate seems to act simply as an absorbent of the excess of liquid which the larva must eliminate as the construction of its pupary is begun. If the process is not carried out under such conditions, pupation in general is imperfect, as was shown when mature larvae were placed in a flask without any absorbent material of any kind. The fact that larvae show an instinct to bury themselves may be explained as defense against excessive heat in the superficial soil layers, as experiments in a culture oven showed that a temperature of 32°C is enough to sterilize them. It was also impossible to shorten the pupal period to a minimum duration of 20 days at a constant temperature.

Adults were observed to live at room temperatures from 4 to 12 days; an increase in temperature decreased their life span, as all adults hatched at 30°C lived 2 days at most. Copulation may begin the first day after hatching, and egg-laying three days after.

Larvae were recorded hatching from eggs laid on *Musca domestica* in the laboratory and on 2 *Stomoxys calcitrans* captured with apparently freshlaid eggs. The periods of incubation were 9, 9 and 8 days respectively.

Various animals were infested with these larvae, and in a dog infected with a larva from the second *Stomoxys*, the complete cycle was observed, as follows : development of the egg, 8 days; development of the larva, 33 days (it was removed), prepupal period, 2 days; pupal period, 37 days; adult period, 5 days; total 85 days. The decisive influence on each of these periods is emphasized.

Some remarks are made in the possibility of using atomic radiation to combat and control bot flies.

333. McGregor, W. S. & L. L. Wade, 1957: El Narlene para el control de la *Dermatobia* en el ganado. *Agroquimica* (Dow) *2* (2): 4-5.
Not seen.

334. Zumpt, F., 1957: Some remarks on the classification of Oestridae s. lat. (Diptera). *J. Entom. Soc. South Africa 20* (1): 154-161, 7 figs.
See chapter 7.

335. Graham, P. H., L. L. Wade, R. W. Colby & W. S. McGregor, 1957: Use of Dow ET-57 for the systemic control of *Dermatobia hominis* in cattle. *Agric. Chem. 12* (10): 51, 109.
Experiments with Dow ET-57 administration to cattle killed 72.6% of the larvae. The first stages are readily killed, but the later stages resist to the action of the insecticide.

336. Braaksma, H. E., 1957: Myiasis caused by *Dermatobia hominis* in Surinam. *Doc. Med. Geogr. Trop. 9* (1): 97-99.
Not seen.

337. Anon., 1957: Perspectiva para le extirpación de la *Dermatobia* en el ganado. *Agroquimica* (Dow) *2* (2): 2.

338. Andrade, W. J. de, 1958: Caso singular de infestação por môsca do gênero *Dermatobia*. *Publ. Med. 30*: 85-87.
Not seen.

339. Graham, O. H., P. Kraemer & O. Alejandro, 1958: Control del tórsalo (*Dermatobia hominis*, L. Jr.) con insecticidas orgánicos fosforados, de acción sistémica. *Turrialba 8* (4): 153-157.
Not seen.

340. Ruiz Martinez, C., 1958: Combata el gusano de monte com Shell Toxafeno 50%. *Mejores Cosechas con Shell*, Caracas *4*.
Not seen.

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351. Graham, O. H., 1959: Cattle grub control with systemic insecticides. *Southwest. Veter. 12*: 267-270.
Tests with Ronnel (ET-57) for the control of *Dermatobia* larvae. The drug was administered orally to the cattle.

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S. pruinosum as vector of *Dermatobia* eggs (p. 34).

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354. Rabello, E. X., 1959: Demonstrações de combate ao berne. *Rev. Soc. Rural Brasil. 39*: 47, illus.

355. Santamaria, F. J., 1959: *Diccionario de mejicanismos,* Editorial Porrua, S. A., Mexico.
Page 274: "COLMOYOTE (Del azt. *ocuilin,* gusano; *moyotl,* mosco. Diversos insectos dípteros de la familia de los estridos y de los géneros *Dermatobia, Hypoderma* y *Oestrus*). M. Díptero grande, de extremidades muy largas, que al picar deposita una larva o gusano (del mismo nombre), blando, retorcido, corto y grueso, blanco con anillos negros en los cuales cría a modo de pestañas. Se arrolla formando un tumor, que destilla por una boca estrecha abundante sangraza, producto de la deyección del animal, que se alimenta de los tejidos subcutáneos, produciendo una picazón peculiar, aguda y desesperante; alcanza hasta dos centímetros de largo por casi uno de grueso. La gente del campo extrae el colmoyote echándole ceniza o agua de tabaco y exprimiendo en seguida el abcesso, para que el animal salga muerto, porque vivo no cede a presión ni cabe en la boca del tumor. Constituye una plaga de las tierras cálidas, principalmente en ciertos roedores (ardillas), marsupiales y monos. En Centro América se le conoce también por *moyocuil* (voz de iguales raíces); por *macaco* en las Guayanas; por *torcel* o *tórsalo,* en Costa Rica; *nuche* y *gusano de monte,* en Colombia."
Page 743 : "MOYOCUIL (Del azt. *moyotl,* mosca, y *ocuilin,* gusano). M. Nombre con que se conoce la larva de un insecto díptero (*Dermatobia* sp.) de la familia de los oestridos, que se desarrolla debajo de la piel de algunos animales y aun del hombre. Lo mismo en la América Central. En Tabasco y Chiapas, *colmoyote.* Produce la enfermedad conocida por *miasis cutánea,* con comezón intolerable y dolor intenso peculiar. Se le extrae por presión en el gran infarto que forma, muerta la larva con ceniza caliente. La ardilla y el mono, entre otros animales, lo padecen ordinariamente."

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Review of the literature, distribution (especially in Central America) and control.

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Experiments with dimethoate and Neguvon.

359. Johnson, W. P., 1960: The effect of dimethoate on *Dermatobia hominis* in cattle. *Amer. J. Veter. Res. 21*: 1046-1048.
Tests with dimethoate, in several concentrations, given intramuscularly, subcutaneously or orally to cattle.

360. Graham, O. H., P. Kraemer & A. Osorio, 1960: Contrarresto del tórsalo con insecticidas orgánicos fosforados sintéticos. *La Hacienda,* La Hacienda Co., Inc., New York *55* (10): 43-45.
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Several experiments with Ruelene.

362. Araújo Costa, H. M. & M. G. Freitas, 1961: Efeito do composto fosforado — Dowco-109 (Ruelene), administrado pela via oral, sôbre a freqüência do berne em bovinos. *Arq. Esc. Veter.*, Belo Horizonte *13*: 145-156.

"Narlene was effective against larvae of *D. hominis* in calves; Narlene 80mg/kg body weight given at intervals of eight weeks controls the grubs satisfactorily; Narlene, administered orally to cattle was non-toxic in doses of 80mg/kg body weight."

363. Colmenares, C. R., 1961: Investigaciones geneticas sobre el ganado colombiano "Bon". *Rev. Veter. Zootecn.*, Manizales *6* (5): 40-73.

The author investigated that some cattle are resistant to *Dermatobia* infestation. Animals can be tested by pouring a drop of larval extract into its eye. Resistance is indicated by blinking, lacrimation, congestion, swelling and intense photophobia; these symptoms disappear with application of water. Susceptible animals do not react. This resistance is due to the paralyzing effects of the lymph on the larvae and is a dominant hereditary factor, indicating a possible selection of a resistant breed.

364. Andersen, E. H., 1961: Systemic insecticides for control of tropical warble-fly (*Dermatobia hominis*) in cattle. *J. Amer. Veter. Med. Assoc. 139* (7): 104-107.

Tests made in Costa Rica with dimethoate given intramuscularly and Bayer L 13/59 as a spray.

365. Casorso, D. R. & V. Mateus, 1962: Studies on *Dermatobia hominis* (L. Jr.). I. Comparison of control methods. *Amer. J. Veter. Res. 23* (95): 879-883.

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366. Anon., 1962: Plano de erradicação do berne. *Correio Agro-Pecuário*, Farbenfabriken Bayer AG *2* (2): 19, 23, 3 figs., 1 graph.

Experiments with Asuntol and Neguvon.

367. Hugh-Jones, M. E., 1962: Dermatobioses in cattle in South America. *Veter. Rec. 74* (35): 961.

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INDEX OF AUTHORS