# LIFE CYCLE OF APODEMOPUS APODEMI (FAIN, 1965) (GLYCYPHAGIDAE: SARCOPTIFORMES)

by

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SUMMARY

*Apodemopus apodemi* is a free living nest inhabitant of *Apodemus sylvaticus, A. flavicollis* and *A. callipides,* with a short free life cycle, correlated with duration of pregnancy of the host and a long-period hypopus stage, endoparasitic in the hair follicles of the tail. Methods for rearing and data on the biology of this species are given. Adults and developmental stages are described, and the systematic position is confirmed. Histological observations could not answer the question of nutrition of the tissue hypopi. The similarity of the life cycle with that of Hypodectidae species is discussed.

## SYSTEMATIC POSITION OF THE GENUS *Apodemopus* FAIN

The heteromorphic deuteronymphs of *Apodemopus apodemi* were first found in the follicles of the hairs upon the tail of *Apodemus sylvaticus.* The species has been placed in the genus *Lophuromyopus* and described under the name *L. apodemi* Fain (1965 c). The hypopi of *Lophuromyopus* and related genera live in a niche only observed in detail in the last years (Fain, 1965a, b, c, 1966a, 1967a, b, c, 1968b, c; Fain & Lukoschus, 1968).

In connection with their endoparasitic way of life these genera lack clasping organs. The species are similar to the family Hypodectidae, the hypopi of which live subcutaneous in birds (Fain & Bafort, 1966, 1967; Fain, 1967a).

Later on Fain (1967d) described the monotypic subgenus *Apodemopus.* This differs from the typical subgenus *Lophuromyopus* chiefly by scapular setae inserted far ahead of the sejugal furrow and by the presence of sclerotized processes dorsally on the idiosoma.

Fain (1968a) succeeded in rearing hypopi of a *Lophuromyopus* species to the adult stage. The adults live free in the nests of rodents, for this group one of us (A.F.) had suggested the genus *Grammolichus* Fain (1968a). Revision of the genus *Lophuromyopus* thus became necessary (Fain, 1968b).

In the meantime, one of us (F.L.) succeeded in rearing hypopi of *A. apodemi* to tritonymps and adults. These adults correspond in general to the genus. They differ, however, in a number of important characteristics, which justify their separation (Fain, 1968b : 162).

These characters are the following: Adults have Y-shaped epimerae I, in the female the vulva is inverted Y-shaped with three distinct valves. The epigynium is lying behind the sternum. The genus differs from the genus *Lophuromyopus* by the following characteristics :

In both sexes: cuticle verrucose and little sclerotized (thick, heavily sclerotized and furrowed in *Lophuromyopus);* presence of only one solenidion on genu I; presence of one seta on femur IV; external vertical setae close together and behind *v i;* no aerial sacs dorsally to trochanter II; absence of solenidion omega 2.

In the male: Penis very short, no genital combs on the forelegs. The shape of the genital opening in the female (inverted Y-shaped with three valves) prevents the placing of the genus within the subfamily Labidophorinae. In this subfamily the vulva is always situated in the longitudinal axis and has only two valves. Two setae on tibiae I and II and the formation of hypopi keep it from the assignement in the subfamily Ctenoglyphinae.

Volgin (1964) described *Lophioglyphus liciosus* out off nest of rodents in Russia. The only figure (dorsal view of the male) published with the description, gives no exact data, but the species seems closely related to *Apodemopus apodemi.* Unfortunately we were not able to borrow paratypes of *Lophioglyphus liciosus* for comparison.

After rearing experiments we now are presenting the entire life-cycle of a *Lophuromyopinae* species, with data on a peculiar biology.

## METHODS OF REARING AND COURSE OF DEVELOPMENT

*Apodemus sylvaticus* populations within the Netherlands, Belgium, Germany, Austria and Switzerland, *A. flavicollis* in Switzerland and Austria, and *A callipides* in Spain (Lukoschus, 1967) are found to be parasitized to a high degree by the hypopi.

Out of 154 investigated wood mice in the environs of Nijmegen, 122 proved to be infected during the month of September (1965—1968). During winter the degree of parasitism is lower, in March and April parasites are rare in gravid mice and absent in lactating mice. In the autumn mice bear from 1 to 182 hypopi per tail, mostly 20—50 parasites are to be found.

On infected parts of the tail enlarged hair follicles can be observed macroscopically, the thickening elevating the posterior border of the scales. By striking over the tails distally with a scalpel or pincers, the hypopi are squeezed from the follicles under the scales.

Initially we succeeded only to rear the adults (Fain, 1968 b). Now we consider the following methods to be nearly optimal. Profitable season is September—October. The storage of the dead, trapped mice should be at 4° C for 3—4 days; than the hypopi are squeezed from the follicles and a part of the tail is amputated. Little glass dishes with dried yeast and parts of the tail are used for rearing. Rims of the dishes are smeared with caterpillar lime to make escape from the dishes visible. Storing of the dishes is at 85% RH, darkness and room temperature. Under these conditions mould appears, apparently necessary for the development of the species.

Hypopi with relatively short legs (Fig. 10, 12), set free as described above, appear to be inert. Two days later those hypopi, which are situated beneath hairs and at scale

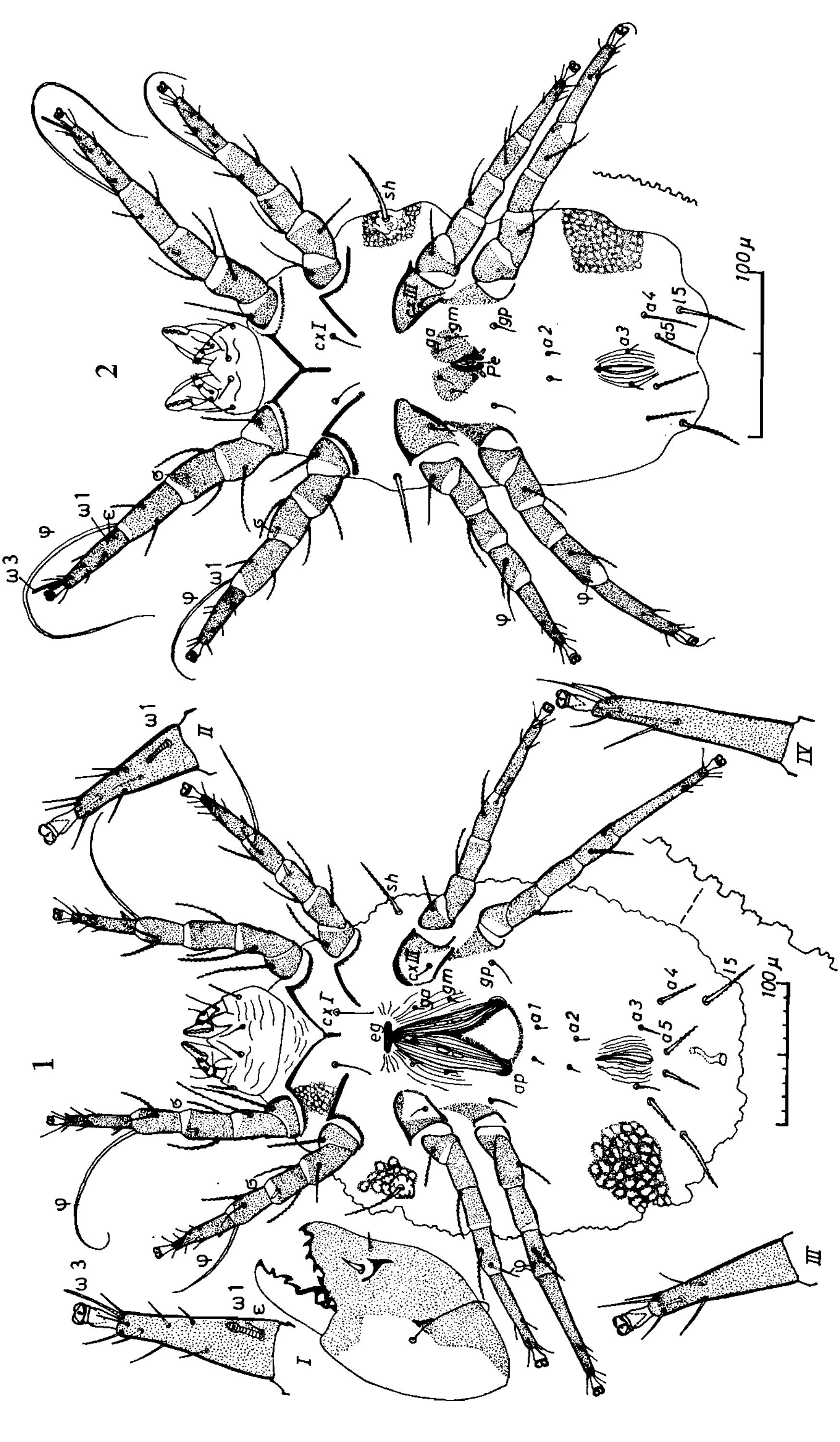

Fig. 1. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968, female venter, chelicera and tarsi I—IV in dorsal view, lateral view of verrucose cuticula
Fig. 2. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968, male venter, lateral view of verrucose cuticula

borders in such a manner that both ventral and dorsal surface come into contact, become unable to move. Preparations of these specimens prove them to be in the process of moulting into tritonymphs. Hypopi glued together by squeezed sebaceous fat and scales, or glued to the surface lying on the back, do not start development even within 14 days, but die after shrinking.

First tritonymphs appear on the 3rd day (Fig. 5, 8). Frequently in fissures of yeast, less upon the tail, tritonymphs enter moulting phase on the 5th day. First adults are present on the 7th day (Fig. 1, 2). Tritonymphs and adults are active in the dishes, but do not try to escape. On the 9th day first eggs are found on the glass bottom, in smaller quantities on yeast and only rarely on the tail pieces. Isolated couples could deposit 24 eggs within 10 days, under laboratory conditions.

Larvae (Fig. 3, 6) are present on the 12th, first protonymphs (Fig. 4, 7) on the 14th and first hypopi (Fig. 11, 13) on the 17th day. Free hypopi are remarkably smaller than tissue hypopi. They have relatively long legs (compare Fig. 10 and 11) and are very active. The conditions in the rearing dishes seem to be not convenient, for most of them become glued on the lime border. For rearing larger numbers of free hypopi use of glass tubes with a cotton stop was necessary.

We did not succeed in observing infestation of the host by free hypopi. Behaviour of hypopi was observed under dissecting microscope upon the tails of arrested *Apodemus* up to 60 minutes. Larger numbers of hypopi, placed on adult wood mice without parasites in the tails, did not make efforts to enter beneath the scales. The following days hypopi were found in the fur. Up to four weeks no hypopi were observed within the follicles of tails of test mice.

Parasitized wood mice trapped in winter did not reproduce in laboratorium mice boxes, their nests had no developmental stages nor adult mites, but nests of free living wood mice with nestlings in May harbour these stages.

Numbers of free hypopi placed on one day old nestlings of laboratory mice and of *Mesocricetus auritus* did not enter juvenile hosts.

Without a drop of temperature only few hypopi became tritonymphs. Even in high humidity tissue hypopi cannot hatch out of follicles of dead unproductive mice.

Mould is necessary for nutrition of tritonymphs. Rearing tests without part of tails and the mould appearing in these conditions, do not produce adults. For egg production only yeast is the suitable food.

## DESCRIPTION OF STAGES

Female. — Length of idiosoma of 10 specimens measured average 383 μ (336—423), width 240 μ (224—266).

Venter (Fig. 1). Cuticle soft, verrucose. Empimera I Y-shaped, coxal field III almost closed. Vulva between coxae III and IV with two stronger sclerotized valves (78 μ) and a soft median valve. Two pairs of small genital suckers. Epigynium (*eg*) and genital apodemes (*op*) small, but strongly sclerotized. Anal opening ventrally at one-fourth from caudal end. Bursa copulatrix ventral subterminal. Gnathosoma with two-segmented palps and large strongly dentated chelicerae. Palpal coxae with two pairs of setae (lateral one pectinate). Palptibia with two, tarsus with one setae and three spines. Chelicerae as figured.

Ventral chaetotaxy. Present are *cx I* 27 μ, *cx III* 12 μ, setiform genital setae *g a* 6 μ,

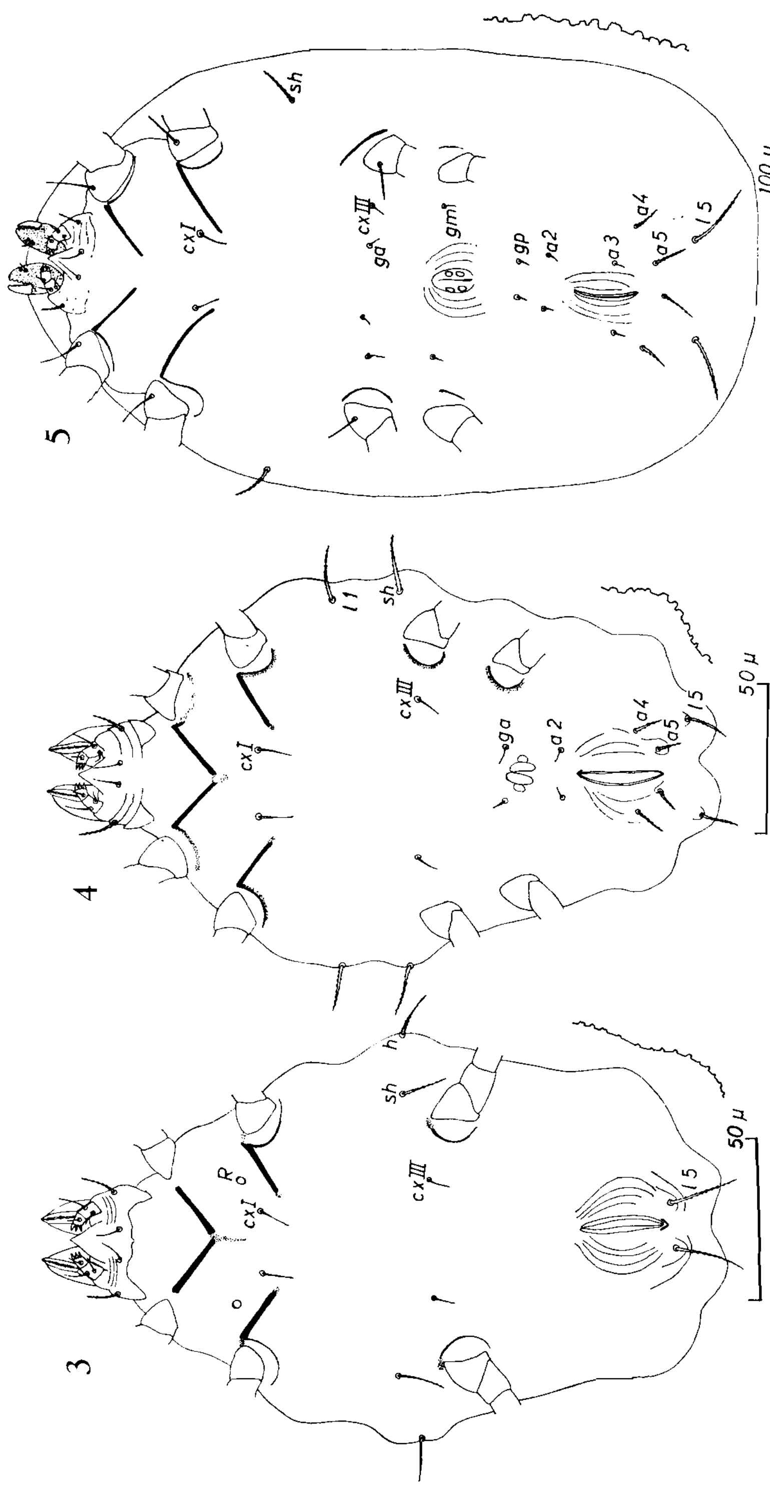


Fig. 3—5. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968. 3, venter of larva; 4, protonymph; and 5, of tritonymph, with lateral view of verrucose cuticula

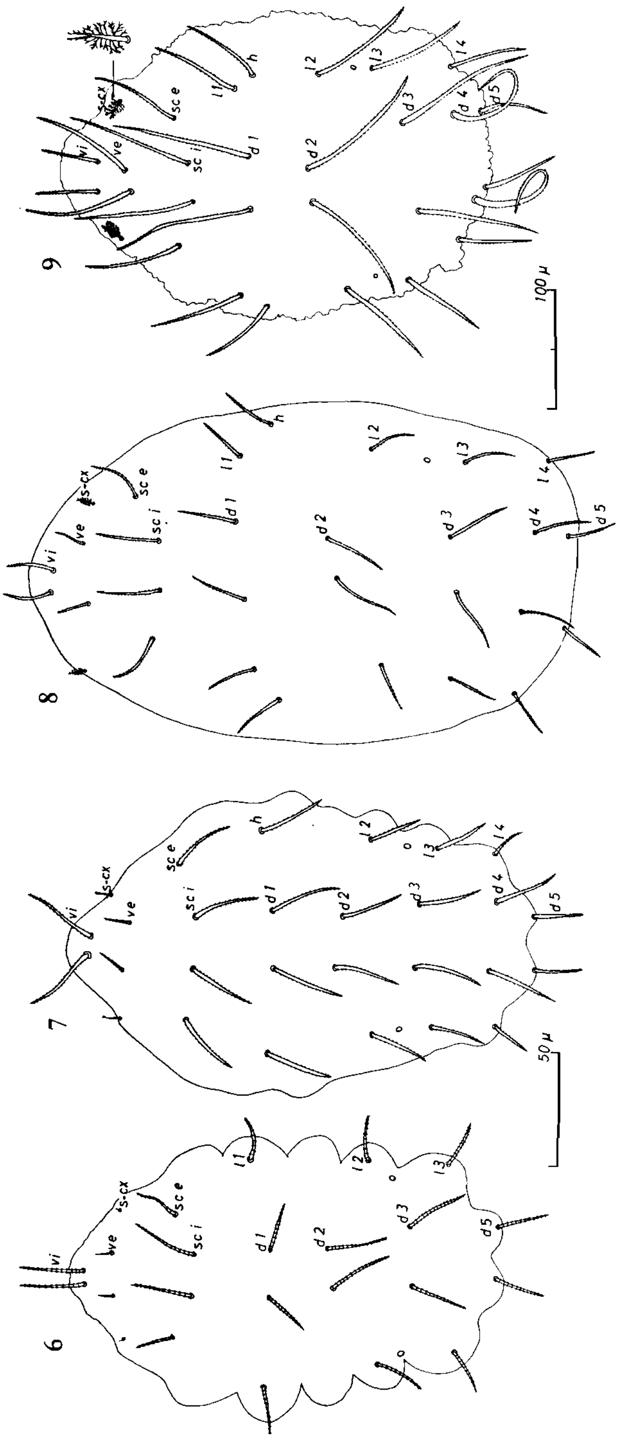


Fig. 6—9. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968. 6, dorsum of larva; 7, protonymph; 8, tritonymph and 9, female

*g m* 7 μ, *g p* 22 μ, anals *1* and *2*, and finely pectinated setae *a 3*, *a 4* 20 μ, *a 5* 28 μ, lateral *5* 43 μ, and subhumeral (*sh*) 44 μ.
Legs with five free segments and long ambulacrum with very little claw. Setae on tarsi all setiform, on trochanteres-tibiae short pectinate.

Chaetotaxy: Tarsi 10—10—8—8, tibiae 2—2—1—1, genua 2—2—1—0, femora 1—1—0—1, trochanteres 1—1—1—0.

Solenidiotaxy : Tarsi 2—1—0—0, tibiae 1—1—1—1, genua 1—1—0—0. On tarsus I famulus is present, omega 2 is absent.

Dorsum (Fig. 9). Cuticle soft, verrucose. All dorsal setae thick and finally pectinated. Present are *v i* in front of *v e*, *sc i* behind level of *sc e*, *d 1*—*d 5*, *l 1*—*l 4*, *h* and multiple branched supracoxal setae. Measurements in table I. Oil gland between laterals *2* and *3*.

M a l e (Fig. 2). — Length of idiosoma in 10 specimens measured 284 μ (266—314), width 176 μ (157—193). Body shape more slender than in female. Cuticle soft, verrucose, papillae smaller than in female. Epimera I Y-shaped, coxal field III closed. Genital opening between coxal regions IV with two triangular genital apodemes. Penis (*Pe*) very short, two pairs of little genital suckers. Chaetotaxy of venter and dorsum like in female, only anal setae *1* are lacking. Measurements in table I.

Chaetotaxy and solenidiotaxy of legs like in female, with the exception of tarsi, these only 8—8—6—6.

T r i t o n y m p h. — Length of idiosoma in 10 specimens measured 353 μ (271—448), width 225 μ (176—277). There is no morphological difference in tritonymphs, which include a developing male or female. Large range of variation in length is caused by mixture of male- and female-forming tritonymphs.

Venter (Fig. 5). Epimera I free. Genital opening between coxae IV with two oblong oval genital valves and two pairs of disk-shaped genital suckers. Chaetotaxy like in female, but anal setae *1* are lacking.

Dorsum (Fig. 8). Chaetotaxy like in female, but all setae shorter and smaller, measurements in table I. Supracoxal setae smaller and less branched.

Chaetotaxy of legs: Tarsi 8—8—6—6, tibiae 2—2—1—1, genua 2—2—1—0, femora 1—1—0—1, trochanteres 1—1—1—0.

Solenidiotaxy: Tarsi 2—1—0—0, tibiae 1—1—1—1, genua 1—1—0—0.

F r e e h y p o p u s. — Length of idiosoma in 10 specimens measured 183 μ (174—190), width 113 μ (106—118). Heteromorphic nymph of the type of cuticole Rodentia parasites without sucker or claw-like organs (Fain, 1965). Cuticle smooth, shiny light brown.

Venter (Fig. 11). — Epimera I fused in V-shape. Epimera III and IV form closed coxal fields III. Epimerites IV lying along genital opening. Genital opening with pairs of genital suckers beneath oblong-oval valvae. Anal opening ventral subterminal with two pint-like setae (*d 5 ?*). Palposoma with two small hairs each, without solenidia. Long pectinate *v i* translocated to venter, *s h* setiform, coxal setae I absent, coxals III only in form of rings. Cuticle wavy-wrinkled, enabling enlargement to tissue hypopus (Fig. 10).

Dorsum (Fig. 13). Strongly sclerotized and punctured dorsal shield covers most parts

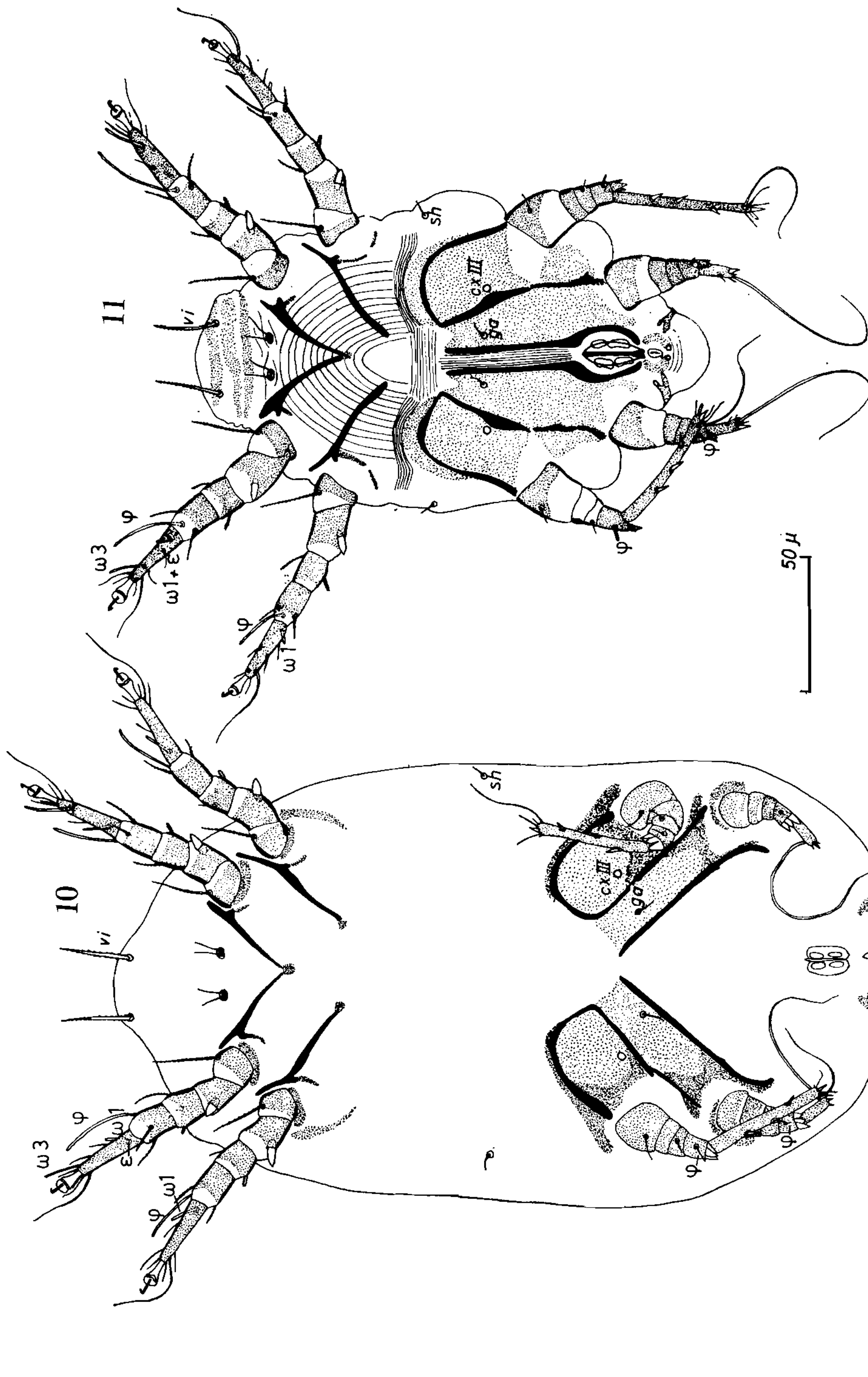


Fig. 10—11. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968. 10, venter of tissue hypopus; 11, venter of free hypopus

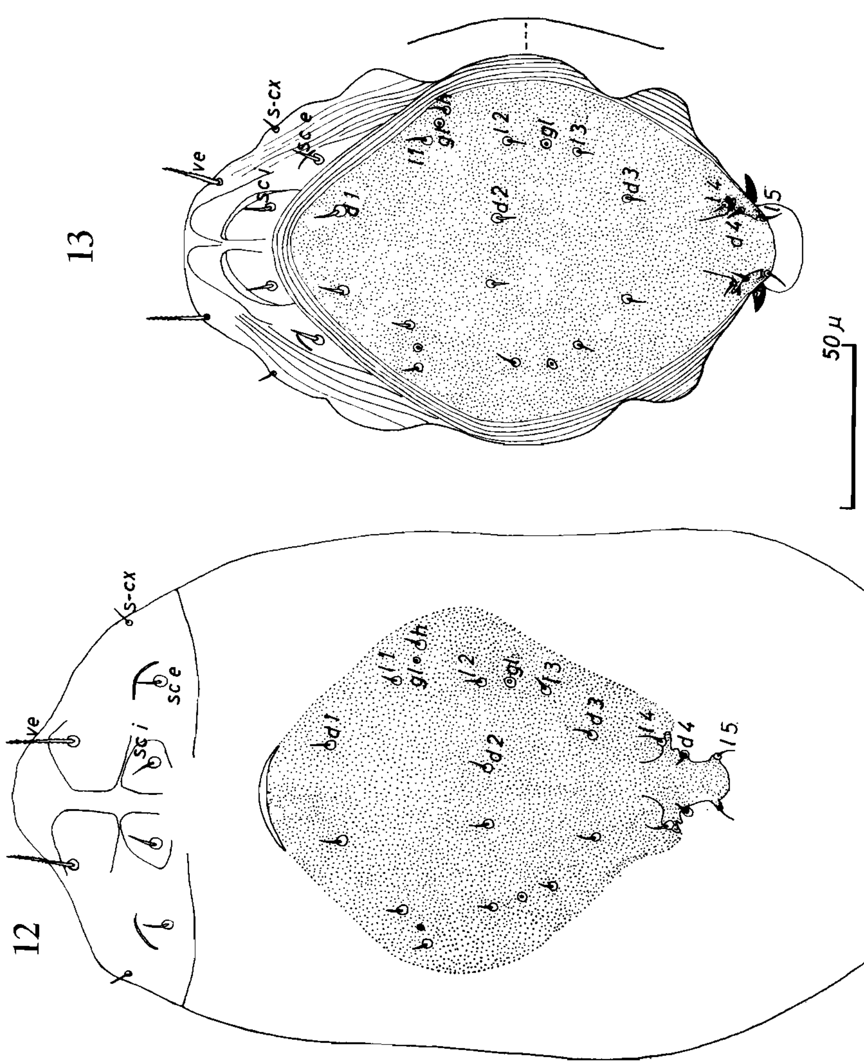


Fig. 12—13. *Apodemopus apodemi* FAIN & LUKOSCHUS, 1968. 12, dorsum of tissue hypopus; and 13, of free hypopus

of dorsum. Soft parts wavy-wrinkled, enabling extension of tissue hypopus (Fig. 12). Vertical external setae pectinate, all other setae setiform to spine-like, also supracoxal setae. Two pairs of gland openings between humeral and lateral *1* and between lateral *2* and *3*. There is no connection of apophysis of pygidial shield with dorsal shield.

Legs I and II with ambulacrum and strong claw, legs III and IV without ambulacrum and claw. Femora I and II with broad flattened seta within deep basis. Tibiae III and IV with hoe-shaped setae with three, sometimes four points within a deep basis. Solenidion omega 3 on tarsus I distinctly displaced more basally.

Chaetotaxy of legs: Tarsi 6—6—9—4, tibiae 2—2—1—1, genua 2—2—1—0, femora 1—1—0—0, trochanteres 1—1—1—0.

Solenidiotaxy: Tarsi 2—1—0—0, tibiae 1—1—1—1, genua 0—0—0—0.

Tissue-hypopus. — Hypopi pressed out of the follicles of tails have smooth, white cuticula, only legs are yellow-brown. Length of 10 specimens measured 322 μ (282—370), width 183 μ (163—214). Venter (Fig. 10) and dorsum (Fig. 12) show clearly stretching of soft, wavy parts of free hypopi.

Protonymph. — Length of idiosoma in 10 specimens measured 178 μ (154—218), width 108 μ (90—137). Body shape and soft, verrucose cuticula like in tritonymph.

Venter (Fig. 4). Epimera I fused in V-shape with little sternum. Genital opening with two valves and only one pair of genital suckers. Only one pair of genital setae (*g m*) and three pairs of anals (*a 2, a 4, a 5*). All other hairs of venter and dorsum (Fig. 7) like in tritonymph. Measurements in table I. Remarkable are supracoxal setae, only two-pointed, *v i* relatively long.

Chaetotaxy of legs: Tarsi 8—8—6—4, tibiae 2—2—1—0, genua 2—2—1—0, femora 1—1—0—0, trochanteres 0—0—0—0.

Solenidiotaxy: Tarsi 1—1—0—0, tibiae 1—1—1—0, genua 1—1—0—0.

Larva. — Length of idiosoma in 10 specimens measured 174 μ (160—196) width 107 μ (90—120). Cuticula soft and verrucose.

Venter (Fig. 3). Epimera I fused in Y-shape. Genital opening, genital setae and anal setae are lacking. Organs of Claparède present in shape of rings (*R*), not protuberant.

Dorsum (Fig. 6). Vertical external and supracoxal setae short and smooth. Dorsals *4* and laterals *4* are absent. Other dorsal setae pectinate and relatively long. Measurements in table I.

Egg. — White with honeycomb pattern, 133 μ long and 64 μ wide. When mounting in Hoyer's mixture, pattern disappears.

## DEPOSITION OF SPECIMENS

Males, females and developmental stages have been deposited within:

Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands.
U.S. National Museum, Washington, D.C., U.S.A.
Institute of Acarology, Columbus, Ohio, U.S.A.
Zoology Department, University of Massachusetts, Amherst, Mass., U.S.A.

Muséum d'Histoire Naturelle, Paris, France.
British Museum (Natural History), London, England.
Institut de Médecine Tropicale Prince Léopold, Antwerpen, Belgium.
Zoologisches Institut und Zoologisches Museum, Hamburg, Germany.
Institute of Parasitology, Academy of Science, Prague, Czechoslovakia.
Bernice P. Bishop Museum, Honolulu, Hawaii.
Zoölogisch Laboratorium, Nijmegen, Netherlands.

## PARASITE-HOST INTERACTION

To observe situation of hypopi *in situ* and to study mite-host interactions, infected tails have been sectioned and stained with haematoxylin-eosin.

Parasites have entered distal parts of hair follicles (Pl. 1, Fig. 1) along the hair of the host (*H*), causing thickening of the epidermis (*Ep*) of hair follicle. Around hypopus (*Hy*) stratum corneum, which is normally thin within hair follicle (*n c*), shows either hypertrophy (*h c*) or paraceratosis (*p c*). Also connective tissues (*c t*) are affected. This is similar to parasitism in *Psorergates* species (Lukoschus, 1967) and nasal mites (Kim & Bang, 1970). Strongly parasitized wood mice often lose epidermis of the tail, because of this degeneration of connective tissues.

The parasite causes epidermal cells to degenerate (Pl. 2, Fig. 3). The nuclei become lighter of colour (*l c*), only traces of them remain (*g*), for some time. In places of degenerated nuclei numerous dark coloured granulae (*gr*) appear (nucleous grit). In a later phase also the protoplasm degenerates (*pr d*). Another form of degeneration (Pl. 2 Fig. 2) is characterized by sickle-shaped nuclei (*s sh*), the concave side always directed to the parasite. All these characteristics are similar to those developed by insect and mite bites (Allen, 1948; Tobias, 1949).

Regarding destruction of tail epidermis and often its entire loss with its results, we consider *Apodemopus apodemi* to be low grade pathogenic.

## DISCUSSION

Our knowledge of the life cycle and the biology of genera and species with heteromorphic deutonymphs (hypopi) living in the phoretic association on mammals, is restricted. Most of the genera and species are described only from hypopi (Fain, 1969). Review of literature on rearing techniques and life cycle is recently given by Lukoschus, de Cock & Fain (1971) in description of life cycle of *Melesodectes auricularis* Fain & Lukoschus, 1968.

In *Apodemopus apodemi* a long period of follicle parasitism, rapid development and reproduction of free living forms, and enlargement of free hypopus to tissue hypopus are remarkable. Development from tissue hypopus to free hypopus occurs within a short time (shortest observed time is 17 days under laboratory conditions). Even if development would be distinctly longer under field conditions, there will be sufficient time for infection of nestlings, because gestation and lactation periods in wood mice are remarkably longer.

Tissue hypopi seem unable to free themselves from the follicles. This is similar to what is observed in genera of the subfamily Hypodectinae, parasites of birds. Developmental cycle has been observed by Fain & Bafort (1966) in *Hypodectes propus*

Nitsch, 1861, subdermal parasite of pigeons. In this species the large tissue hypopi are eliminated by the bird. This is suggested to be affected by hormonal conditions of the bird while breeding. Hypopi give direct development to adults, which do not feed. From the numerous eggs hatch small free hypopi (larval and protonymphal stages are only rudimentary within the egg shell). Free hypopi enter the young nestling and extend 7—10 times. In *A. apodemi* similar enlargement occurs (compare Fig. 10 and 11), but to a less extent. In this species feeding is not restricted to hypopial stage only, like in *Hypodectes,* but free living stages also need appropriate food. Yeast, a suitable nutrient for free living mites, is sufficient for reproduction and development of free hypopi, but is not sufficient for development of adults. We are not sure whether mould alone, rising from the tail parts in rearing dishes, contains all factors needed for development, or whether also debris from the host, available on the tails in the rearing tubes, are necessary. Host-born debris is present in nest under field conditions. Dependence on hostal debris has been observed in *Melesodectes auricularis* and *Marsupialichus marsupialis.*

Development into the adult stage and reproduction seem to be very variable according to the genera observed. Fain (1968b, 1969b) succeeded in rearing hypopi of *Lophuromyopus* and *Rodentopus* without food to adults, but obtained no eggs and no further development. Working with *Labidophorus talpae* and *Orycteroxenus dispar,* Fain (1969c) succeeded in obtaining tritonymphs, but was unable to rear adults from the latter. In *Dermacarus sciurinus* Koch, 1841, we succeeded to get a whole developmental cycle by storing tails of the host at 85% relative humidity.

Feeding of hypopi without mouth parts is still an open question. Hypopi enlarge enormously within tissues, and tissues show characteristic degenerations, as observed from stinging insects and mites possessing salivary glands with extraintestinal digestion. It may be suggested that enormous dorsal glands act in such a way; however, the place of osmotical absorption is still unknown.

## BIBLIOGRAPHY


Allen, A. C., 1948. Persistent "insect bites" (dermal cosinophilic granulomas) simulating lymphoblastomas, histiocytosis, and squamous cell carcinomas. *Am. J. Pathol.* 24: 367—388.

Fain, A., 1965a. Quelques aspects de l'endoparasitisme par les acariens. *Ann. Parasitol.* 40: 317—327.

———, 1965b. Un nouveau type d'hypope, parasite cuticole de Rongeurs Africains (Acari : Sarcoptiformes). *Z. Parasitenk.* 26: 82—90.

———, 1965c. Nouveaux genres et espèces d'Acariens Sarcoptiformes parasites. *Rev. Zool. Bot. Afr.* 72: 252—256.

———, 1966. Note sur les Acariens nidicoles à deutonymphe parasite tissulaire des Oiseaux (Hypodectidae : Sarcoptiformes). *Rev. Zool. Bot. Afr.* 74: 324—330.

———, 1967a. Les hypopes parasites des tissus cellulaires des oiseaux (Hypodectidae : Sarcoptiformes). *Bull. Inst. r. Sci. nat. Belg.* 43: 1—139.

———, 1967b. Nouveaux hypopes vivant en association phorétique sur les rongeurs et des Marsupiaux (Acarina : Glycyphagidae). *Acarologia* 9: 415—434.

———, 1967c. Les Hypopes des Glycyphagidae nidicoles en Afrique au Sud du Sahara. *Ann. Mus. roy. Afr. centr. Tervuren* 157: 1—89.

———, 1968a. Acariens nidicoles et détriticoles en Afrique au Sud du Sahara. III. Espèces et genres nouveaux dans les sous-familles Labidophorinae et Grammolichinae. *Acarologia* 10: 86—110.

———, 1968b. Acariens nidicoles et détriticoles on Afrique au Sud du Sahara. IV. Découverte du cycle évolutif d'un Acarien du genre Lophuromyopus FAIN, 1965 (Glycyphagidae : Sarcoptiformes). *Rev. Zool. Bot. Afr.* 78: 161—174.

Fain, A., 1968c. Un hypose de la famille Hypoderidae Murray, 1877 vivant sous la peau d'un rongeur (Hypoderidae : Sarcoptiformes). *Acarologia* 10: 111—115.

———, 1969a. Les deutonymphes hypopiales vivant en association phorétique sur les mammifères (Acarina : Sarcoptiformes). *Bull. Inst. r. Sci. nat. Belg.* 45: 1—262.

———, 1969b. Acariens nidicoles et détriticoles en Afrique au Sud du Sahara. V. Description du cycle évolutif de deux espèces du genre Rodentopus, Fain. *Acarologia* 11: 304—316.

———, 1969c. Morphologie et cycle évolutif des Glycyphagidae commenseaux de la Taupe, Talpa europea. *Acaologia* 11: 750—795.

Fain, A. & J. Bafort, 1966. Les hypopes parasitant les tissus cellulaires sont les deutonymphes d'un acarien libre et pas celles d'un acarien plumicole. *Rev. Zool. Bot. Afr.* 74: 315—316.

Fain, A. & J. Bafort, 1967. Cycle évolutif et morphologie de Hypodectes (Hypodectoides) propus (Nitzsch) acarien nidicole à deutonymphe parasite tissulaire des pigeons. *Bull. Acad. Rov. Sci. Belgique*, 5. Sér. 53: 501—533.

Fain, A. & F. Lukoschus, 1968. Une nouvelle deutonymphe hétéromorphe (hypope) parasite du blaireau (Meles meles) en Hollande (Acarina : Sarcoptiformes). *Rev. Zool. Bot. Afr.* 78: 175—182.

Kim, C. S. & B. G. Bang, 1970. Nasal mites parasitic in nasal and upper skull tissues in the baboon (Papio sp.). Science 169 : 372—373.

Lukoschus, F., 1967. Krätzmilben an spanischen Kleinsäugern. *Rev. Iber. Parasitol.* 27: 203-228.

Lukoschus, F. S., A. W. A. M. de Cock & A. Fain, 1971. Life cycle of Melesodectes suricularis Fain & Lukoschus, 1968 (Glycyphagidae : Sarcoptiformes). *Tijdschr. Ent.* (in press).

Tobias, N., 1949. Tickbite granulema. *J. investigat. Dermatol.* 12: 255—259.

Volgin, V., 1964. New genus and new species of mite of the subfamily Ctenoglyphinae (Glycyphagidae) from the nests of Rodents. *Acad. Nauk. S.S.S.R. Parasitogieski sbernik* 22: 100—110.

Table I. Length of setae. Measurements in μ.

| | male | female | trito-nymph | hypope | proto-nymph | larva |
|---|---|---|---|---|---|---|
| coxal I | 18 | 27 | 15 | - | 11 | 10 |
| coxal III | 18 | 12 | 8 | 0 | 8 | 6 |
| genital anterior | 11 | 6 | 6 | 6 | - | - |
| genital median | 10 | 7 | 7 | - | 6 | - |
| genital posterior | 15 | 22 | 6 | - | - | - |
| anales 1 | - | 7 | - | - | - | - |
| anales 2 | 8 | 9 | 5 | - | 4 | - |
| anales 3 | 8 | 11 | 6 | - | - | - |
| anales 4 | 33 | 28 | 13 | - | 10 | - |
| anales 5 | 25 | 28 | 18 | - | 8 | - |
| vertical internal | 49 | 50 | 41 | 24 | 34 | 29 |
| vertical external | 80 | 94 | 28 | 19 | 12 | 7 |
| scapular internal | 74 | 106 | 42 | 9 | 31 | 29 |
| scapular external | 72 | 81 | 52 | 9 | 30 | 20 |
| supracoxal | 18 | 18 | 13 | 5 | 8 | 3 |
| humeral | 59 | 69 | 45 | 5 | 18 | 14 |
| subhumeral | 41 | 44 | 23 | 6 | 17 | 14 |
| dorsal 1 | 66 | 117 | 50 | 8 | 34 | 23 |
| dorsal 2 | 67 | 117 | 52 | 6 | 29 | 29 |
| dorsal 3 | 74 | 113 | 54 | 6 | 29 | 28 |
| dorsal 4 | 67 | 120 | 46 | 6 | 32 | - |
| dorsal 5 | 51 | 65 | 39 | 0 | 22 | 22 |
| lateral 1 | 62 | 74 | 41 | 7 | 30 | 23 |
| lateral 2 | 64 | 93 | 41 | 6 | 24 | 22 |
| lateral 3 | 67 | 83 | 43 | 6 | 24 | 22 |
| lateral 4 | 60 | 65 | 41 | 5 | 18 | - |
| lateral 5 | 41 | 43 | 36 | 6 | 14 | 24 |
| solenidion phi I | 170 | 106 | 83 | 33 | 60 | 49 |
| solenidion phi II | 98 | 70 | 54 | 21 | 33 | 29 |
| solenidion phi III | 21 | 21 | 18 | 5 | 4 | 4 |
| solenidion phi IV | 5 | 5 | 3 | 3 | - | - |
| solenidion $omega_1$ I | 9 | 10 | 9 | 6 | 7 | 6 |
| solenidion $omega_3$ I | 20 | 31 | 20 | 12 | - | - |
| length tarsus I | 49 | 46 | 33 | 25 | 23 | 20 |
| length tarsus II | 39 | 44 | 31 | 24 | 20 | 18 |
| length tarsus III | 44 | 59 | 33 | 48 | 27 | 25 |
| length tarsus IV | 54 | 78 | 36 | 13 | 31 | - |

## EXPLANATION OF PLATES

Plates 1 and 2. Longitudinal sections of *Apodemus sylvaticus* tails parasitized by *Apodemopus apodemi.* Bouin-fixation, 7 $\mu$-sections, haematoxyline-eosine-staining.

Plate 1 Fig. 1. Parasitised hair follicle.

Plate 2 Fig. 2 and 3. Parasitised hair follicle, details of epidermis.

# REGISTER VAN DEEL 115

* Een sterretje duidt een naam aan nieuw voor de wetenschap.
* An asterisk denotes a name new to science.
Synoniemen zijn *cursief* gedrukt.
Synonyms are printed in *italics*.

Uit dit register zijn weggelaten de namen voorkomende in artikelen welke reeds werden voorzien van eigen registers, nl. die van sommige Lepidoptera (pp. 1—121, index p. 121), Hymenoptera Sphecidae (pp. 153—203, index p. 203), en Hymenoptera Apoidea (pp. 253—324, index p. 323), in dit deel.


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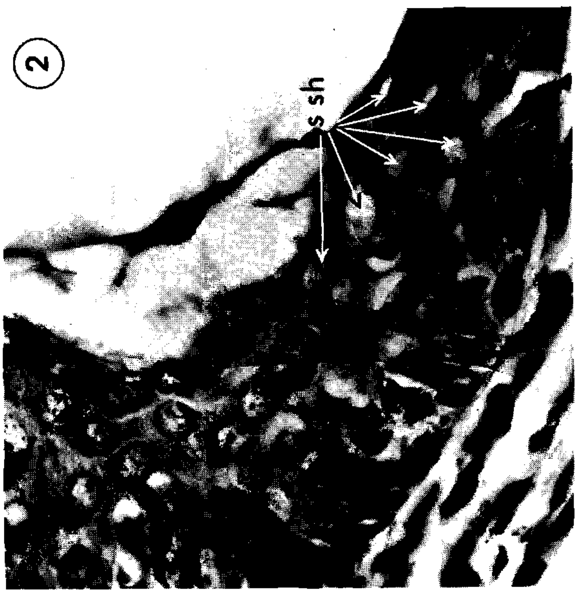


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