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Dosen:
Prof. Dr. Ir. Rudy C. Tarumingkeng (penanggung jawab)
Prof. Dr. Ir. Zahrial Coto
Dr Ir Hardjanto

BIOLOGY AND CONTROL OF HEAD LICE (*Pediculus capitis* de Geer) (PHTHIRAPTERA: PEDICULIDAE)

By:

MARTHY L. STELLA TAULU
A461034011/ENT
lingkan67@hotmail.com

I. INTRODUCTION

Lice, all members of Exopterygota; are ectoparasites on birds and mammals. Features common to all lice are as follows:

(1) Body and head of lice are flattened dorsoventrally;

(2) Neither wings nor their vestiges are present;

(3) Antennae are composed of 3 – 5 segments;

(4) Spiracles are in dorsolateral position on the abdomen;

(5) Tarsi have 1 or 2 segments; and

(6) Ocelli are absent (Kluge, 1980; Horsfall, 1962).

Anoplura is the group that includes human lice; it contains about 560 blood-sucking species, which only live on mammals (Kluge, 1980), and each species has host-specific. There are 3 types of human lice:

1. **Head lice (*Pediculus capitis* de Geer)**
    a. This species occurs on the head, about the ears and occiput. However, from reliable statements made by a number of observers, in heavy infestations, it may establish itself on other hairy parts of the body (Herms and James, 1965).
    b. The legs are similar in length, powerful and curiously modified for climbing among hairs (Busvine, 1980).
    c. Abdomen is elongated without lateral hairs (Busvine, 1980).
    d. Head lice do not transmit disease in human (Anonymous, 1999b).

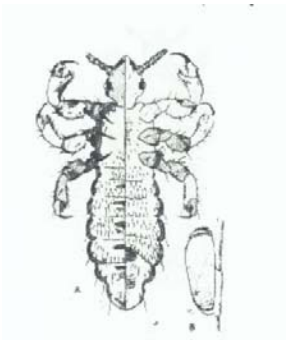

Figure 1. Head lice (*P. capitis*): A. adult (x35); B. egg attached to human hair (x60) (Clay, 1973 *In* Smith, 1973).

2. **Body lice (*Pediculus humanus* Linnaeus)**
    a. Body lice infest the clothing where it comes in close contact with the body rather continuously, e.g., the fork of the trousers, the armpits, the waistline, neck, and shoulders (Herms and James, 1965).
    b. More resistant to starvation (Busvine, 1980).
    c. The legs are similar in length (Busvine, 1980).
    d. Abdomen is elongated without lateral hairs (Busvine, 1980).
    e. Body lice are a major vector for three important human diseases that is relapsing fever, typhus, and trench fever (Cheng, 1964).

Figure 2. Body lice (*P. humanus*) (Horsfall, 1962)

3. Pubic lice (*Pthirus pubis* Linnaeus)

a. Pubic lice are most frequently found around the pubic and peri-anal region of the infested person, but may also be found elsewhere on the body.

b. The body is crablike, which is rather wide than humanus and capitis (Cheng, 1964).

c. The legs are adapted to grasping rather large hairs and, in the position adopted, the adult prefers hairs rather widely spaced.

d. The forelegs are slender with long fine claws whereas the middle and hind legs are thick with claws (Noble and Noble, 1976).

e. The abdomen is shorter with lateral hairs (Busvine, 1980).

f. Very little is known the importance of pubic lice as a transmitter of human disease (Busvine, 1980).

Figure 3. Pubic lice (*P. pubis*) (Horsfall, 1962)

II. TAXONOMY OF HEAD LICE

The taxonomic position of head lice is indicated below:

Class : Insecta
Subclass : Pterygota
Suporder : Exopterygota (= Hemimetabola)
Order : Phthiraptera
Suborder : Anoplura
Family : Pediculidae
Genus : Pediculus
Species : *Pediculus capitis*

(Kluge, 1989; Clay, 1973 *In* Smith, 1973).

Eggs. The eggs (or 'nits') of head and body lice are similar. The head lice egg is approximately oval and rather large for the size of the insect, being about 0.8 x 0.3 mm. Viable eggs are pearly yellowish-white and opaque; after hatching they become translucent and opalescent. Live eggs are brownish in color and dead eggs are whitish in color (Anonymous, 1999d; Busvine, 1966). The egg has a peculiar lid or operculum, which opens after about 6 days to let the nymph hatch out (Smith, 1964).

Adult and Nymphs. The first stage nymph is straw-colored. Anatomically, the nymphs are very similar to the adults, the primary differences being (1) size and proportion, and (2) absence of external sexual organs in nymphs (Busvine, 1966). The length of nymphs is about 1-mm (Noble and Noble, 1976).

Herms and James (1961) wrote that head lice are gray in color, but tend to resemble the color of the hair of the host. The male averages 2-mm in length and the female 3-mm (Herms and James, 1961). The head bears a pair of antennae, which are together waved from side to side with a characteristic testing motion as the insect advances. The eyes are poorly developed, which is compatible with the retiring parasitic habits of the lice (Busvine, 1966).

III. BIOLOGY OF HEAD LICE

3.1. Life cycle

The number of eggs deposited by female ranges from 50 to 150. These are glued to the hair and hatch in from 5 to 10 days, with an average of 7 days (Herms and James, 1961). Percentage of eggs to hatch is 88% at temperature of 30^{o}C (with period of maximum egg production) (Pattons and Evans, 1929; Busvine, 1966).

When eggs hatch, a nymph resembling a miniature replica of an adult louse emerges. The young nymph requires a blood meal within a few hours of hatching (Burgess, 1980), and will feed several times a day as it develops through three immature stages to the adult in about 10 days (Cheng, 1964).

Faust *et al* (1962) mentioned that the adults live about 30 days, during that time each female produces 5 to 10 eggs daily. A single female produced between 80 to 100 eggs. The females live for 32 to 40 days, while the life span of adult's males is slightly shorter. The egg-to-egg cycle generally takes 3 weeks (Cheng, 1964).

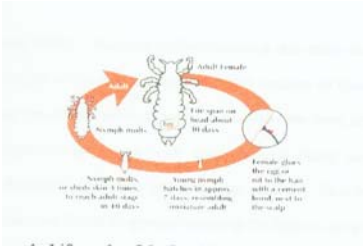

Figure 4. Life cycle oh head lice (Anonymous, 1999a)

3.2. Infestation

Infestation with head lice is highest when over a period of time people is crowded into sleeping quarters and where facilities for bathing and washing are minimal. Children occasionally acquire head lice at school, probably during play. Lice rapidly spread through the family group and it is a common experience of school medical officer that children disinfect at school is repeatedly reinvested at home (Busvine, 1966).

3.3. Feeding

Lice only engorge after period of starvation, and then, like a flea, pass out unchanged blood. The head lice, under natural condition, feed frequently and also

discharge large quantities of dark excreta, which adheres to the hair, each feeding lasting a few minutes. They are most active at night when people are asleep (Busvine, 1966; Pattons and Evans, 1929; Smith, 1964).

3.4. Transmission

Head lice are transferred from one person to the next by direct contact or indirect contact. Personal articles may become infested when head lice accidentally dislodged onto them. Indirect transmission is usually from infested brushes, combs, towels, pillows, clothing, stuffed toys, earphones, hats, caps, and other hair accessories, etc (Anonymous, 1999c; 1999d; Pattons and Evans, 1929; Borror *et al*, 1976; Rosen *et al*, 1996). Transfer of head lice through these sources is less likely than through head to head contact. This is because head lice cannot live away from their host for a long time.

3.5. Vector Potential

The presence of lice on any part of body is called pediculosis. Head lice rarely (if ever) cause direct harm, and they are not known to transmit infectious agents from person-to-person. Lice may occasionally be burdensome because of annoyance and their presence may cause itching and loss of sleep. The saliva and feces may people sensitive to their bites, thereby exacerbating the irritation and increasing the change of secondary infection from excessive scratching (Anonymous, 1999a). Excessive scratching to relieve the itch can lead to serious infection from bacteria getting into broken skin (Anonymous, 1999c).

IV. CONTROL OF HEAD LICE

4.1. Chemical control

Current remedies for head lice are available in three main formulations: (1) shampoo, (2) crème rinse, (3) lotion. Shampoo and crème rinses are more popular because they ere easier to apply and are cosmetically more acceptable. However, lotions are theoretically more effective because length of application allows more penetration of the toxic ingredients to the lice and eggs (Chunge *et al*., 1991). Table 1 lists the common

insecticidal active ingredients and trade names of products, which are marketed as pediculicides for head lice.

4.2. Non-chemical control

Heat. The heat produced by standard hand-held hair dryers may suffice to kill head lice and their eggs on a person's hair. A clothes dryer set a high heat or a hot pressing iron may effectively kill any lice and eggs, on pillow cases, sheets, and nightclothes, towels, and similar items that will not be damaged by this process (Anonymous, 1999b). Clothes, towels, and bed linens that may harbor lice or eggs can be washed in water or dry cleaned or put in dryer on hot setting for 20 minutes or sealed in a plastic bag for two weeks, then washed normally (Anonymous, 1999c). In early days head lice infestations were treated by shaving the head, or at least cutting the hair short (Busvine, 1966). This drastic procedure is no longer essential, but in very bad cases some shortening of the hair may be desirable. **Freezing**. Freezing temperatures may kill lice and their eggs on inanimate objects (e.g. toys). Objects that cannot be heated in a clothes dryers may be placed in a freezer. This treatment may require several days to be effective depending on the temperature and humidity (Anonymous, 1999b).

Table 1. Some Pediculicides that are used for Treating Head Lice in the U.S and Other Countries .

States	CHEMICALS (using pediculicides)			
	Botanicals	**Thiocyanates**	**Chlorinated Hydrocarbon**	**Others**
Canada	-Pyrethrum extracts (Pyrefume Super 20 & Pyrefume Super 30 (1943) -A-200 Pyrinate® Liquid/Shampoo -Pyrethroid Nix (crème rinse) -Pyrethrin R&C shampoo, Rid shampoo	-Lethane 384 (early 1940's -Bornate®	-Lindane (Kwellada®)	-Benzyl benzoate (50% emulsion) Organophosphat -Prioderm (lotion)
U.S	-MYL powder (prior to 1944) -A-200 Pyrinate® liquid/shampoo -Licetrol 400® & Pedic® -Rid®	-Barc® & Bornate®	-Topocide lotion -Lindane (Gamene® & Kwell®)	- Cuprex®

Malaysia	Rotenone (Derris sp.)			
East Indies	Rotenone (Derris sp.)			
Central & South America	*Lonchocarpus* sp. (Fabaceae)			
Britain	AL 63 dust	-Lethane 60, Lethane 384 & Lethane 384 Special	-Quellada® (lindane)	Organophosphorus compounds -Prioderm® lotion & shampoo -Derbac® liquid Carbame insecticides -Derbac® shampoo
Holland				Organophosphorus compounds -Prioderm
Indonesia			Peditox (hexachlorocyclohexane 0.5%)	Gameksan (Gammexanum 10 mg)

V. CONCLUSIONS

There are 3 types of human lice: (1). Head lice (*P. capitis*), (2). Body lice (*P. humanus*), and (3). Pubic lice (*P. pubis*). Adults of head lice live about 30 days, during that time each female produces 5 to 10 eggs daily. A single female produced between 80 to 100 eggs. The females live for 32 to 40 days, while the life span of adult males is slightly shorter. The egg-to-egg cycle generally takes 3 weeks.

Head lice are cosmopolitan; they can infest anybody, although some groups appear to be more susceptible than others; children are more susceptible than adults. Infestation with head lice is highest when over a period of time people is crowded into sleeping quarters and where facilities for bathing and washing are minimal.

Head lice are a public health problem mostly because they affect social distress and not because they transmit disease. The symptoms of an infestation with head lice are commonly very mild. Exposure to lice saliva from hundreds of bites leads to irritation and in some cases allergic reaction. Severe scratching infrequently leads to secondary bacterial or fungal infections.

Infestations of head lice causes human to seek some treatment to control them. There are synthetic insecticides that can apply externally to human body and which are

prepared and marketed as drugs or medicine. Besides this chemical control, sometimes non-chemical control can be used to treated head lice.

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