STUDIES ON THE INSECTICIDES USED FOR THE CONTROL OF HARD TICKS IN EGYPT

By
AHMED EL-NABAWI MOHAMED
(B.Sc.)

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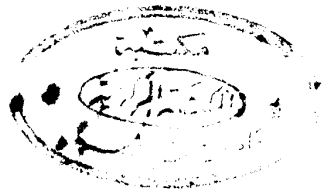

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A C K N O W L E D G E M E N T S

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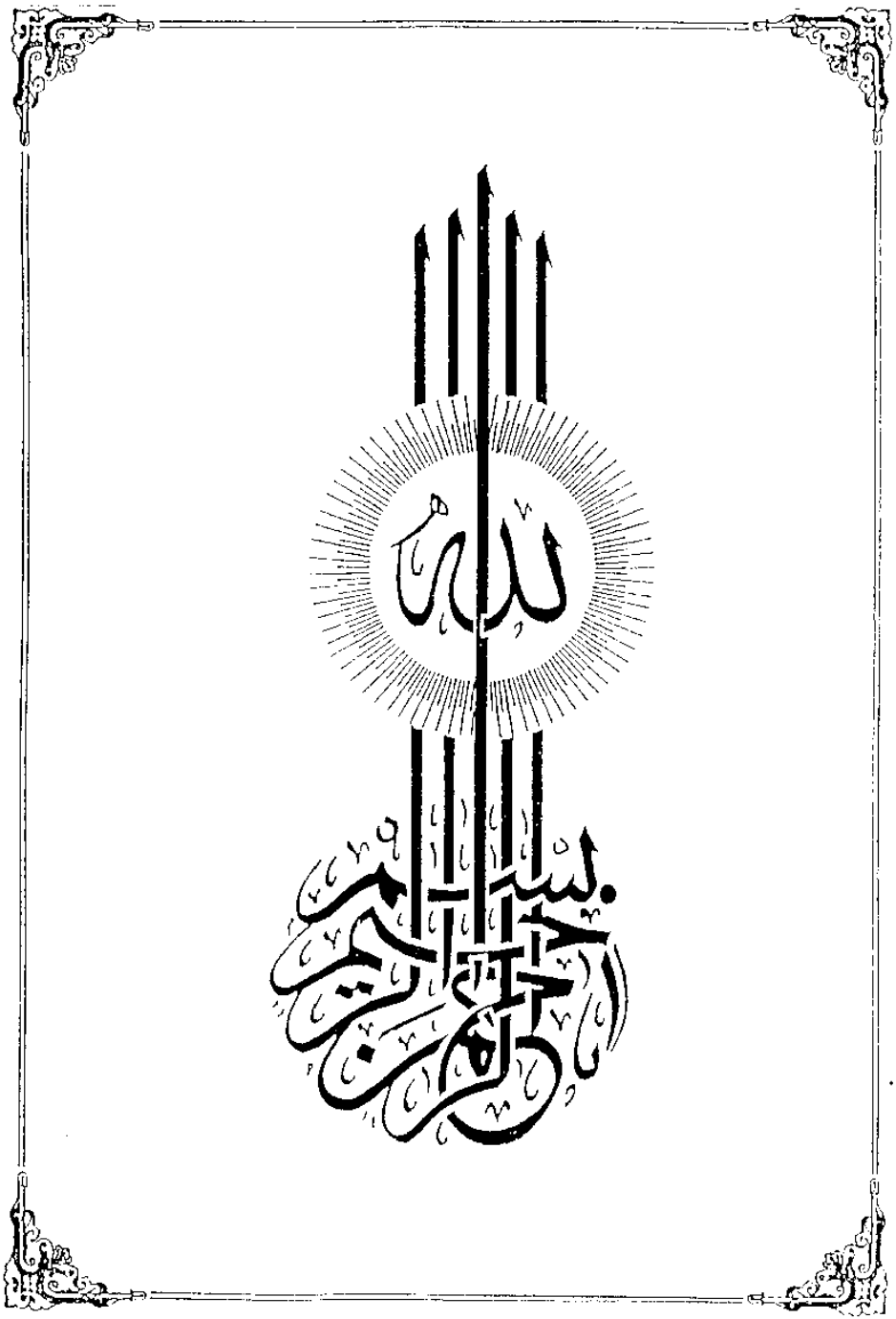

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Hard ticks are terrestrial arthropods that live on the blood of vertebrate animals higher than fishes, particularly mammals.

Stockmen suffer enormous losses due to ticks infesting cattle and other stock. Hunter and Hooker (1907) reported that as many as 200 pounds of blood might be withdrawn from a large host animal by ticks in a single season.

Woodward and Turner (1915), using Boophilus annulatus (Say), found that tick-infested cows under experimental conditions gave only 65.8 per cent as much milk as tick-free cows. Furthermore, the tick-free cows gained 6.1 per cent in body weight during the time of the experiment, while the tick-infested animals gained 3.6 percent.

Death due to exsanguination by ticks is believed to be possible. Ticks also act as vectors for numerous pathogenic microorganisms that cause serious diseases in animals and man. Adults of few, if any, ixodids regard man as a host of predilection but many attack him in the absence of other available hosts. Larvae and nymphs are much more common and serious pests of man than adults (Hermes 1961).

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It was necessary to carry out a preliminary survey of hard ticks infesting the three host animals; cows, donkeys, and sheep; before conducting our experiment to control them. The preliminary survey indicated that Boophilus annulatus had the highest average density throughout the present study. Therefore, three different insecticides; Baodip, Supona, and Carbaryl were tested against hard ticks infesting cows, donkeys, and sheep. The effect of these three insecticides on the reproduction of B. annulatus was studied as an indication for evaluating the effectiveness of test insecticides in the control of hard ticks on host animals.

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REVIEW OF LITERATURE

I - Studies on hard ticks infesting Animals:

Hard ticks used in the present study are Boophilus annulatus, Hyalomma excavatum, Hyalomma dromedarii, and Rhipicephalus S. sanguineus. Boophilus annulatus (Say, 1821) is the so called Texas fever tick. It is known as a North American cattle tick (Hoogstraal, 1956) that may be originally found on deer and buffaloe. It also has been introduced into the Mediterranean basin. In North Africa and the Near East, it frequently is referred to as B. calceratus (Birula, 1894). Hoogstraal referred to that parasite as one host tick.

Hassan et al (1958) concluded that B. annulatus was to a great extent uniformly distributed in the five studied localities of Alexandria, Shebin El-Kom, Cairo, Beni Suef and Faiyum. It increased with the rise of temperature and it was greatly influenced by humidity. They found that the percentage of Boophilus annulatus collected from different hosts were as follows: horse (0.00), donkey (1.19), dog (0.42), goat (2.97), sheep (0.95), camel (0.51), buffalo (59.54), and cow (69.81). They found that the dominant species on cows and

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[illegible] Small (1957) and R. [illegible]
[illegible] Theiler (1958) mentioned R. sanguineus
as one of the main species of ticks in Egypt.
Soliman (1959) mentioned that Boophilus annulatus
infested camels and donkeys but they were not the
main hosts.

Hoogstraal (1956) reported Hyalomma excavatum
(Koch, 1844) (Hyalomma s. anatolicum (Koch, 1844))as
a three-host species, while Hassan et al., (1958)
considered it as a two-host tick. Hoogstraal (1956)
stated that H. excavatum infested, cattle, horses,
donkeys, camels, buffaloes, sheep, goats, swine, and
[illegible] and dogs. Hassan et al (1958) found
that H. excavatum infested buffaloes, cows and [illegible]
rarely found on donkeys, horses and camels. Hoogstraal
and Kaiser (1959) reported H. excavatum [illegible]
on camels [illegible] in desert and semi-desert [illegible]
[illegible] of camels in the [illegible]
[illegible] excavatum. [illegible] and
[illegible], followed by [illegible], and
[illegible] camels.

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[illegible] et al. (19[illegible]) [illegible] [illegible] H. excavatum [illegible] during winter [illegible] to diapause. Hyalomma excavatum usually undergoes a winter diapause (Hoogstraal and Kaiser, 1959).

Hyalomma dromedarii (Koch, 1844) is called the camel hyalomma. Delpy and Geuchey (1937) suggested Hyalomma dromedarii to be the most highly adapted of all ixodid ticks to desert conditions. They considered that species as a three-host tick that might be only a two-host tick under unfavourable conditions, while Hoogstraal (1956) found it usually a two-host tick. Hassan et al (19[illegible]) considered that species as a three-host tick. They reported that camel was the main host of adults but the infestation included all domestic animals except horses. The same authors found from their work in several localities in Egypt that H. dromedarii was mainly abu[illegible] [illegible] [illegible] (19[illegible]) [illegible] that H. dromedarii [illegible]

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Rhipicephalus s. sanguineus (Latreille, 1806) is the so called Kennel tick. Cooley (1946) stated that Rhipicephalus s. sanguineus was probably the most widely distributed tick species in the world, with the possible exception of the fowl argas (Argas persicus).

The life cycle of R.s. sanguineus had been studied, under laboratory conditions by christophers (1907 C), Hooker et al (1912), Patton and Cragg (1913), Nuttal (1915), and Regendanz and Reichenow (1931). All studies concluded that it was a three-host tick. Hoogstraal (1956) mentioned that the tick hosts available for R.s. sanguineus were vast and included numerous medium and large size mammals wherever the tick occured. In addition to mammals, many larger ground-feeding birds and a few reptiles were infested with that species. He added that different climatic and ecological conditions affected the parasite's life cycle and its relation to different hosts. Hassan et al (1958) reported that all domestic animals were infested with that species. The same authors found that the dominant species on sheep, goats, dogs, donkeys and horses was R. s. sanguineus which was uniformly

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(1956) [illegible] R.s. sanguineus were once found on the chest of man. Smit (1961) stated that the kennel tick R.s.sanguineus infested all kinds of the examined animals and was mainly abundant on dogs followed by goats and scarcely cats.

Gaud and Mrin (1935), Sergent and Poncet (1937) and Hoogstraal (1956) observed the presence of seasonal variation in the density of tick infestation. [illegible] et al (1958) found that R. s. sanguineus tended to increase with the rise of temperature in the studied localities. In Cairo area, Egypt, the same authors reported that the highest population density of the larvae of this species was found in July. The larvae were absent from December to March. The highest population density of the nymphs was found in May and September, October, but nymphs were absent from [illegible] to March. The highest population density of adults was found in September. But they were found during winter. [illegible] always higher than [illegible]. [illegible] et al (1958) mentioned that R. s. sanguineus [illegible] species on sheep, was usually found in small numbers

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[illegible] in much less numbers on their hosts.

II - Studies on the Effects of Insecticides on Hard Ticks:

A. Susceptibility of Hard Ticks to Insecticides:

1 - Laboratory Techniques:

In the evaluation of insecticides for the control of the cattle tick *Boophilus annulatus* (Say) most of the workers apparently have not screened the new compounds for their toxicity to the ticks before treating the infested animals. The new materials used for the control of *Boophilus spp.* on cattle have usually been selected on the bases of their toxicity to insects or ticks. However, numerous investigators in several parts of the world have developed laboratory techniques for evaluating insecticides against *Boophilus* ticks *in vitro* principally to facilitate the study of resistance and to compare the toxicity of insecticides in terms of median effective concentration or a similar statistic. One of the earlier laboratory procedures was that of Whitnall and Bradford (1947). The engorged females of *Boophilus decoloratus* (Koch) that had been manually removed from cattle, were immersed in the test material for five minutes. Then they were held for one hour on

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[illegible] Arnold (1948) conducted similar tests in Jamaica using B. annulatus microplus. He found that the 5-second immersion was effective as well as 15-second immersion. Hitchcock (1953) used the moults of B. a. microplus that had dropped from cattle after engorgement, and he assumed that those adults had the same physiological conditions. Stone (1957), Stone and Meyers (1957), and Stone and Webber (1960) used the technique of Hitchcock with some more refinements. Graham and Drummond (1964) mentioned that most workers preferred to use engorged females because of their greater resistance to insecticides and more uniform response. Shchalilov (1966) found that Carbaryl (W.P.) was highly toxic to Ixodes persulcatus Schulze when tested in the Soviet Union. The values of LD_{50} for larvae nymphs, and adults exposed to pieces of treated plywood in the laboratory, were 0.009, 0.021 and 0.08 gm. active ingredient per sq. m. respectively. El-Kordiry (1967), performed preliminary tests using spray technique to determine the LC_{50} of malathion, Delnav, and Lindane on the larvae of R. s. sanguineus.

Several methods of assessing ixodicidal resistance in ticks have been used with varying degrees of

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[illegible] adult [illegible] dipped in emulsions, suspensions or solutions (Stone, 1968). Engorged ticks had been tested by placing [illegible] treated filter paper (Mount et al, 1968). Adults [illegible] been treated topically by injection (Stone, 1968), and larvae have been placed in special envelopes of rice paper, similar to tea-bags, and immersed in the dipping fluid (Fielder, 1968).

Hadani et al. (1968) used a laboratory method for the study of ixodicides by dipping unfed nymphs of Hyalomma anatolicum excavatum Koch in a gauze bag for ten seconds in different concentrations of the test compound. Dipping was followed by blotting and placing 50 individuals in clean tubes and assessing the mortality after 24 hours.

Solit (1965) used topical application to determine the LD_{50} dieldrin, malathion and fenthion on field collected adult ticks on beta Hyalomma dromedarii [illegible] R.S. Sanguineus.

Gratz, et al (1972) used engorged larvae of Rhipicephalus s. sanguineus which were collected, 3-4 days after detachment from guinea pigs in envelopes

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(4 X 5.5 cm) made of heat-sealable tea-bag paper. Larvae molted to nymphs 8 - 12 days after detachment. At 14 - 15 days after detachment, the envelopes were treated by dipping in the insecticide. The envelopes were held for 24 hours after treatment and then the percentage mortality was determined. In a test of 26 insecticides at various concentrations, the LC_{50} values ranged from 0.000023 % for pyrethrins + piperonyl butoxide (1 : 10) to 0.88 % for dieldrin, while the LC_{50} values for suponá and carbaryl were 0.00075 and 0.0052 % respectively. Also the tea-bag technique was used for time-mortality tests of dieldrin, chlordane, heptachlor, and methoxychlor. Mortality did not increase drastically with time.

2 - Control of Hard Ticks on Animals:

Drummond and Medley (1965) performed tests using insecticidal sprays for the control of ticks on cattle and horses. Twenty-two compounds were compared with 0.5 percent toxaphene as a standard treatment. Nineteen compounds were tested against Amblyomma Americanum (L.) infesting cattle heavily at the period of April - July. Only eight compounds were at least as effective as toxaphene which gave 70 percent

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