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Studies on Certain Ectoparasites Associated with Some Farm Animals and their Control

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Abstract

The present work was carried out on animal ectoparasites during the period from 2007 to 2010 in Animal farm of Assiut University. The study included the population survey of ectoparasites on animal bodies, soil and associated rodents and controling the animal ectoparasites. Results indicated that there is a difference in ectoparasites depending on animal kind, e.g., ticks on cattle, lice on buffalo and fleas on sheep, and the relationship between rodent and animal ecttoparasites was assessed. Also, the population density of ectoparasites was increased in spring season and reduced in winter season except fleas on sheep which its population density was increased in winter season and reduced in summer season. Mechanical and chemical control can be used to reduce animal ectoparasite populations and worked as a good tool in the program of ectoparasite control on animal bodies, soil and control of rodent species.

Key words of dissertation phd thesis

animal- sheds, farm animals, rodent species, population density, animal ectoparasites, Animal manure pests, Associated rodents, Buffalo lice, cattle ticks, Buffalo and sheep mange, anticoagulant rodenticides, *Arvicanthis niloticus, Rattus rattus frugivorus, Rattus rattus alexandrines* and attractant and repellent rodent baits

CHAPTER (1)

STUDIES ON CERTAIN ECTOPARASITES ASSOCIATED WITH SOME FARM ANIMALS AND THEIR CONTROL

INTRODUCTION ... REVIEW OF LITERATURE.. MATERIALS AND METHODS

INTRODUCTION

Ruminants such as cattle, sheep and goats are worldwide important sources of human food and different economically important goods such as leather and/or wool, etc. Therefore, they are reared often in masses and in monocultures, which are highly attractive for many ectoparasites **(Eckert *et al.*, 2009 and Schnieder, 2008)**. Many of these ectoparasite species have their breeding sites very close to their hosts, so that they are practically always present. Of course, the speed of the development of ectoparasites is temperature dependent. This implicates that their presence and numbers vary according to the different seasons during the year (especially in milder and temperate climates).

Many ectoparasites harm the health of their hosts by blood sucking (e.g., ticks, mite, simuliids, midges, biting flies, fleas, lice and bugs). This leads primarily to often enormous losses of blood. Furthermore, the biting sites become super infected with bacteria, and these wounds attract licking flies. In addition, some of the blood-sucking ectoparasites may act as vector of some diseases, such as ticks may transmit stages of Babesia, Theileria, Rickettsiales, Anaplasma, several bacteria, and viruses, which causes several diseases or even death to the hosts **(Raether and Harder, 2008; Mehlhorn *et al*., 2008; Eckert *et al.*, 2009).** Blood-sucking insects such as biting flies, simuliids, or midges are known vectors of similar agents of disease, as midges turned out as vectors of the Bluetongue virus serotype 8, which overwhelmed cattle and sheep in Europe during the outbreak of 2006-2009 (**Mehlhorn *et al.*, 2009;Conraths *et al.*, 2007; Hoffmann *et al.*, 2009).**

Simuliids are known to transmit filarial worms as well as causes painful bites to cattle **(Dettner and Peters, 2010)**. Non-blood sucking insects may introduce several diseases to the animal. Licking flies may transport a great variety of causes of diseases on their labellae (=the terminal saliva-containing parts of their mouthparts) onto wounds or lips and nose and thus they may initiate several diseases (bacteriosis, virusis, or even parasitosis) **(Förster *et al.*, 2009)**.

Some other ectoparasites just found in the skin of ruminants, such as the mallophaga feed on skin and at the basis of hair and induce harmful effect in its structure which lead to lowering its quality as a leather when used . Many mite species (*Sarcoptes*, *Psoroptes*, *Chorioptes*) enter the skin either totally or at least in parts, thus causing wounds and hindering the further use of the skin as leather of high quality. The same is true for the members of the scaled bot flies (*Hypoderma*, *Oestrus*), which leave large hollows in the skin along the back of the animal, where the *Hypoderma* larvae have their final breeding sites just before falling down to earth in order to pupate there.

All these different attacks of ectoparasitic and/or part time endoparasitic ticks, mites, or insects made it necessary to block their aggressive attacks by repellents to be placed onto the animals and to decrease the number of aggressors in the surroundings of herds by application of insecticides and acaricides on the skin of farm animals and/or on the breeding sites of the ectoparasites. Such activities of prophylaxis or control need knowledge of the developmental of life cycle and on the periods of occurrence of the ectoparasites as well as on their breeding sites.

Unfortunately, research on entomological topics has been decreased during the last 30–40 years so that basic data of many important ectoparasites are rather old or even lacking. Thus, there is an extreme need to update such data in order to get the most efficient control and to avoid development or increase of potential resistances. **(Eckert *et al.*, 2009; Dettner and Peters, 2010)**

The economic impact from changes in animal husbandry and the need for increased parasite surveillance and control have increased the need for a better understanding of the current distribution and prevalence of livestock and domesticated animal ectoparasites, the success in using the effective pesticides and some recent trends for controlling as main step in ectoparasites eradication. Ectoparasites controlling program depends on identifying the species of the parasites under local environmental conditions.

The parasitic arthropods infesting farm animals have not gained much attention in upper Egypt .So, the present work of investigations aims to study the following topics:

1- Survey of animal farm pests in the studied area, in addition to animal farm ectoparasites.
2- Survey of rodents and their ectoparasite as carriers.
3- Determination of population density of ectoparasites.
4- Control of ectoparasites on buffaloes, cattle and sheep.
5- Studies the effect of attractant and repellent baits on rodent.
6- Evaluation of some rodenticides used in a large scale in Egypt.

REVIEW OF LITERATURE

1. Ecological studies:

1.1. General survey of pests inhabiting farm animals in the area of study:

Byford *et al*. (1992) found that the horn fly, *Huernatobia irritans* (L.), is the most important pest of cattle throughout the United States and discussed its greatest economic importance to pastured cattle.

Abo Elmaged (1998) recorded five species of rodents, twenty six species of mites (Astigmata and Mesostigmata), three species of ticks, thirteen species of flies, three species of mosqutoes, three species of fleas, two species of lice, two species of ants, two species of cockroaches, one species of scorpion and one species of spiders in animal farm of the Faculty of Agriculture in Assiut University throughout three years.

Grabovac and Petrić (2003) identified Flies of five families and nine genera on stock farms during their study. The families were represented: Muscidae, Calliphoridae, Tachinidae, Sarcophagidae and Drosophilidae. They found the larvae of most species during the study are coprophagous, detritophagous or necrophagous while adults are hematophagous (*Stomoxys calacitrans* L.), molestants, and have a vector role.

Peter *et al*. (2006) in South Africa, found that many blood feeding flies and mosquitoes parasitise humans and/or pastured livestock, such as horn flies (*Haematobia irritans*) and the buffalo fly (*Haematobosca stimulans*), are major pests, and stable flies *(Stomoxys calcitrans*).

Meerburg *et al.* (2007) found that flies can be considered as a serious pest in animal production, for example, stable flies (*Stomoxis calcitrans*), the common housefly (*Musca domestica*) and the lesser housefly (*Fannia canicularis*). Also they found, the housefly is the most frequently encountered around pig houses.

1.2. Survey and population of ectoparasites:

1.2.1. Animal ectoparasites:

Harris *et al.* (1982) studied insect fauna which were collected from cattle droppings at 2 locations in Oahu, Hawaii, one in the wet east side (Kualoa) and another in the dry northwest side (Poamoho). From these areas, 7 species of Scarabaeidae were collected. The most numerous species were *Onthophagus gazalla* F., *Onthophagus Sagittarius* (L.), and *Aphodius lividus* (Oliver). Four species of Hydrophilidae were collected of which *Cercyon quisquilius* (L.) was the most numerous of the predator beetles, 9 species of Staphylinidae [*Oxytelus* sp., *Philonthus* (probably *longicornis* Steph.), *Philonthus rectangulus* Shp., *Philonthus discoideus* Grav., *Philonthus* sp., *Platystethus* sp., *Lithocharis* sp., *Eulissus* sp., and *Xantholininae* sp.] and 2 Histeridae [*Pachylister caffer* (Erich.) and *Hister nomus* Erich.]; all in low numbers except the

Oxytelus species. Dipterous larvae, in 6 families and other unidentified families, were collected. In general, beetles were more abundant at Poamoho than at Kualoa and dipterous larvae were more abundant at Kualoa.

Milnes *et al*. (2003) followed over two winter periods a group of 61 cattle which were naturally infested with lice. Data were collected on the number of lice found at various body sites over this period. Summary statistics were produced and due to the repeated measured and hierarchical structure of the data, multi-level analysis was used to model the population dynamics of *Bovicola bovis* and assess the influence of the various hierarchical levels. A four level Poisson model was produced-level one, the individual number of lice at each parting; level two, the body site examined (shoulder, midline or rump); level three, the time of the inspection and level four, the animal. Seasonal fluctuation in lice numbers was modelled using a cosine function transformation of time. A seasonal pattern was seen in both year's with lice counts higher in the first than the second year. The midline area was the most sensitive to detection of *B. bovis*. Variance contributed by the individual animal was less than that contributed by the body site examined and the time of the inspection. The model suggested that lice numbers within the shoulder and rump sites were near random following a Poisson distribution, but aggregation of lice occurred at the midline site with the distribution between animals following a Negative Binomial Pattern. The midline site was the most sensitive site for detecting *B. bovis*. Infestation numbers were higher in the first winter when cattle were younger. In the second winter, there was no difference in lice numbers between cattle exposed to infection for the first or second time.

Deem *et al*. (2005) collected *Amblyomma* sp. (larvae) and *Rhipicephalus ziemanni* Neumann from dead forest buffalos in Congo.

Hussain *et al*. (2005) found during their study for chemotherapeutic control of lice infestation in cattle and buffaloes that sucking lice were the most common ectoparasites of cattle and buffaloes.

Sargison (2005) found that sheep scab is a highly contagious and rapidly progressive disease of sheep of all ages, caused by infestation with the non-burrowing mite *Psoroptes ovis*. The disease occur in most sheep-producing countries, with the notable exceptions of Australia and New Zealand.

Kaal *et al*. (2006) conducted epidemiological and clinical study of flea infestations in farm animals in northern Libya. They found that 150 sheep out of 12, 130 sheep, 23 goats from 2981 examined and 11 calves out of 1124 cattle were infested with fleas.

Reeves *et al.* (2006) collected 6 species of lice, *Anaplasma marginale*, *Bartonella* spp., *Brucella* spp., *Borrelia recurrentis*, *Coxiella burntii*, *Francisella tularensis*, from rats and domestic cattle throughout 13 governorates in Egypt in there study for testing these species for as pathogens.

Yakhchali and Hosseine (2006) studied the ectoparasites of sheep and goats in the northwest region of Iran. They found that ectoparasites (ticks, mites, lice, and fleas) were collected from 77 sheep (6.4%) and 119 goats (9.9%), with an overall prevalence of 8.2%. Ticks were the most frequent ectoparasites. Adult ticks (849) were collected and identified: the highest number belonged to the *Rhipicephalus bursa* (90.7% of sheep and 88.8% of goats), followed by *R. sanguineus* (6.9%), *Boophilus annulatus* (2.4%), plus *Ornithodoros lahorensis* (2.6%). Fifty-two sheep (67.5%) and 85 goats (71.4%) were infested with three species of lice. These were *Damalina ovis* (58.8%) and *D. caprae* (71.4%), *Haematopinus species* (on sheep 76.6% and on goats 62.2%), *Linognathus stenopsis* (36.1%), *L. ovillus* (29.4%). The seasons of highest infestation were fall and winter (50%), the least being spring and summer. Of these, two sheep (2.6%) were infested by *Sarcoptes scabiei*, maximum infestation occurring in winter. *Ctenocephalides felis felis* comprised of all the fleas collected (16.8% of goats, and 13% of sheep). Flea infestation was more widespread in fall and winter (10.2%) than in spring and summer (6.1%).

Tefera and Abebe (2007) studied the ectoparasites of small ruminants in three districts (woredas) of the eastern part of Amhara Regional State, Ethiopia, from November 2003 to March 2004, with the objectives of determining the prevalence of ectoparasites and identifying the potential risk factors associated with the problem. Out of 752 sheep and 752 goats examined, 50.5% of sheep and 56.4% of goats were infested with one or more ectoparasites. The ectoparasites identified in sheep were *Damalina ovis* (38.5%), *Melophagus ovinus* (12.5%), tick infestations (3.4%) and *Linognathus* spp. (2.4%). In goats, parasites such as *Linognathus* spp. (28.3%), ticks (22.2%), sarcoptic mites (6.1%) and *Ctenocephalides* spp. (8.1%) were identified.

Veneziano *et al*. (2007) examined 762 water buffaloes in Italy, in order to detect the presence of lice, they found *Haematopinus tuberculatus* in 11.0% (14/127) of the farms and 4.5% (34/762) of the animal.

Kakar and Kakarsulemankhel (2008) examined 404 cows and 386 buffaloes in Pakistan. They found that 28.96 and 25.64% respectively, gave positive results for ectoparasites. The prevalence of ticks, lice, mites and mixed infection was found to be 10.14, 7.17, 5.19 and 6.43%, respectively in cows and 6.99, 9.84, 4.92 and 3.88% respectively in buffaloes. It was concluded that the prevalence of ectoparasites in cows was higher than in buffaloes due to differences in feeding habits and hygienic habitats of the two species

Muhammad *et al*. (2008) found that the infestation rates of important genera of ticks infesting cattle in Frontier Region, Peshawar, Pakistan were as follows: *Boophilus* (43.40%), *Hyalomma* (36.65%), *Rhipicephalus* (16.88%) and *Amblyomma* (3.05%), while infestation rates by ticks of these genera in buffaloes were 53.12, 31.25, 15.62 and 3.05%, respectively on different livestock species in Faisalabad (Pakistan).Generally, Infestation rates were 28.2 and 14.7% in cattle and buffaloes, respectively. Most livestock species carried more than one genera of ticks. Ticks of the genus *Hyalomma* were the most prevalent in cattle and buffalo, followed by those belonging to *Boophilus*.

Rahbari *et al*. (2008) found that one hundred fifty six species of *Pulex irritans* were collected from sheep, goats, cattle, chicken and human, which consisted of 92.8% of all recovered fleas. Chickens infested by three species of fleas including *Pulex irritans* (84.6%), *Ctenocephalides canis* (12.9%) and *Ceratophilus gallinae* (2.5%).Two hundred and eighty nine cases of animal and 244 cases of human infestation were recorded among the suspicious populations, the most prevalence of infestation was found in sheep and goat herds whilst chicken flocks infested with the lowest rate and cattle were infested moderately.

Ramzan *et al*. (2008) found that the main species of ecto-parasites observed on cattle in Dera Ghazi Khan (Pakistan), were *Boophilus microplus, Boophilus annulatus, Hyalomma aegyptium, Psorcoptes bovis, Sarcoptes Scabies var bovis, Haematopinus tuberculates* and *Linognathus vituli.*

Tasawar *et al*. (2008) studied the lice infestation at a private cattle farm, situated in Multan, Pakistan,and found that ninety two percent buffaloes were infested with *Haematopinus* spp., 6% with *Damalinia* spp. and 2% with *Linognathus* spp. The relationship between sex of animal and different lice was also determined. It was 94.1% in females for *Haematopinus* spp., 5.8% for *Damalinia* spp. and 2.35% for *Linognathus* spp., while in males it was 80, 6.66 and 0 percent, respectively.

Corn *et al*. (2009) examined small mammals, birds, white-tailed deer, *Odocoileus virginianus* (Zimmermann), and feral cattle, *Bos taurus* L., at nine premises, in mountainous rain forest, and in surrounding areas in western St. Croix. They found that small Asian mongooses, *Herpestes javanicus* (E´. Geoffroy Saint-Hilaire), yielded 1,566 ectoparasite species, and including larvae of a soft tick, *Carios puertoricensis* (Fox); the tropical horse tick, *Anocentor nitens* (Neumann); and the southern cattle tick, *Rhipicephalus* (*Boophilus*) *microplus* (Canestrini); black rats, *Rattus rattus* L., yielded 144 specimens, representing six ectoparasite species, including *C. puertoricensis*.

Tanasak *et al*. (2009) surveyed the ectoparasites on domestic animals in the Royal Thai Army areas of operation along the Thai-Myanmar Border, Tak Province, Thailand, and found eleven different ectoparasites as following: two species of hard ticks (Ixodidae), three species of fleas (Siphonaptera) and 6 species of sucking or chewing lice (2 species each in the suborders Anoplura, Ischnocera and Amblycera). Domestic dogs (*Canis lupus familiaris*) (*n*=94) were found infested with 2 species of flea *Ctenocephalides felis orientis* (86.2%) and *Echidnophaga gallinacea* (1.1%), one species of tick, *Rhipicephalus sanguineus* (21.3%), and one louse species, *Heterodoxus spiniger* (7.4%).

1.2.2. Rodents ectoparasites:

Maher Ali *et al.* (1974) found that there is a direct relationship between fleas density in burrows and on rats.

Abdel-Gawad and Maher Ali (1982) recorded four species of mites (i.e. *Ornithonyssus bacoyi*, *Echinolaelaps echidninus, Dermanyssus gallinae and Phipicephalus sp*.) associated with the rodent species in the cultivated and semi-arid areas in Assiut Governorate.

Baker *et al*. (1995) collected four species of mites, *Ornithonyssus bacoti, Laelapsnuttalli, Dermanssus gallinae, and Allodermanyssus sanguincus* from commensally rodent *M. musculus, R. r. alexandrinus and R. norvegicus* in many Egyptian Governorates.

El-kady *et al.* (1995) recorded four species of mites *Eulaelaps stabularis, Laelaps nuttalii, Ornithonyssus bacoti*, and *Dermancyssus gallinae* from *Rattus norvegicus, R. r. alexandrinus,* and *R. r. frugivorus,* in Ismailia Governorate.

Baker *et al*. (1996) collected four species of fleas *Xenopsylla cheopis, Xenopsylla ramesis, Pulex irritans* and *Leptopsylla segnis*, from *Mus musculus*, *Rattus rattus, R. norvegicus* in some Egyptian Governorates.

Zahedi *et al*. (1996) studied the ectoparasites of the common house rat, *Ratrus ratrus diardii* from Kuala Lumpur city, Malaysia for over a period of one year. they found that 73'% of the rats harboured the flea *Xenopsylla cheopis*, followed by mites *Laelaps eckidninlrs* 64%**,** *L.nuttalli* 31% and lice *Polyplax spinulosa* 21%. It was noted that rats from semi-urban areas were mostly infested with mites; 50% were infested with *L. nuttalli* and 38% with *L. echidninus*. In addition, 55% were infested with the lice *P.spinulosa* and 12% with *Hoplopleura pucifica*, as well as 22% of the rats were infested with the flea *Xcheopis.*

Embarak (1997) recorded 16 species of mites, two species of ticks, two species of lice (*Polyplax spinulosa* and *Haplopleura oenorydis*) and two species of fleas (*Xenopsylla cheopis* and *Pulex irritans*) during study the ectoparasites of rodents in Assiut Governorate.

Battesti *et al*. (1998) collected sixteen ectoparasite species from 50 wild rodents, from August 1990 to August 1991, in an area of Araucaria augustifolia forest, in the municipality of Tijucas do Sul, State of Paraná, Brazil. Ectoparasites infested 98% of the rodents, with the highest indices of infestation found in the drycool season. Ectoparasite/host associations were significant ($p<0.01$) for *Gigantolaelaps wolffsohni*/*Oryzomys nigripes*, *Polygenis pradoi*/*Oxymycterus* sp. and *Amblyopinus* sp./*Oxymycterus* sp. The following represent new host records: *Polygenis (Polygenis) tripus* from *Akodon serrensis* and *Hoplopleura sciuricola* from *Sciurus aestuans*.

El-kady *et al*. (1998) found three ectoparasite species, *Polyplax spinulosa* (lice), *Allodermanyssus saguineus* (mites), *Xenopsylla dipodilli* (fleas) in *Acomys cahirinus* from saint cathrine area, Egypt.

El-Deeb *et al.* (1999) collected three species of ectoparasites fleas *Xenopsylla cheopis, Leptopsylla segins, Echidonphaga gallinacea*, and three lice species namely *Polyplax cheopis,polyplax vacillata, P. spinulosa* and four mite species *Ornithonyssus bacoti*, *Laelps nuttalli*, *Echinolaelaps echidnius* , and *Haemolaelps glasgwi* from three rodent species *Rattus r. frugivorus*, *Meriones shaw* and *Mus musculus* in new reclaimed areas of Egypt.

Wilamowski (1999) considered the oriental rat flea, *Xenopsylla cheopis*, as a parasite of the two rat species, *Rattus norvegicus* and *Rattus rattus,* in Israel.

Bochkov *et al.* (2000) identified sex mites of the family myobiidae, *Austromybia persics* sp., *Austromyobia merioni bochkov*, *Rodofordia acomys*, *Rodofordia affinis*, *Graphiurobia dyromys*, and *Myobia murismusculi*, in Iran on the rodents *Gerbillus cheesmani*, *Meriones libycus*, *Acomys cahirinus*, and *Mus musculus.*

Durden *et al.* (2000) recorded that one species of fleas *Polygenis gawyni*, and two of ticks *Dermacentor variabilis, Ixodes scapularis* from *Rattus rattus rattus* in the two locations in north western Florida, USA.

Lance *et al*. (2000) recorded 19 species of ectoparasitic arthropods (2 sucking lice, 4 fleas, 4 ticks, 2 mesostigmatid mites, 5 chiggers, 2 fur mites) from 106 rodents belonging to 5 species (cotton mouse, *Peromyscus gossypinus*, n=64; cotton rat, *Sigmodon hispidus*, n=23; eastern woodrat, *Neotoma floridana* , n=9; golden mouse, *Ochrotomys nuttalli*, n=9; eastern gray squirrel, *Sciurus carolinensis* , n=1) at Tall Timbers Research Station, Leon County, Florida. During the same period, 13 species of ectoparasites (2 sucking lice, 1 flea, 3 ticks, 3 mesostigmatid mites, 2 chiggers, 2 fur mites) were recovered from 57 rodents belonging to 3 species (*S. hispidus*, n=40; black rat, *Rattus rattus* , n=16; *S. carolinensis*, n=1) from Panama City, Bay County, Florida. Noteworthy ectoparasite records include Ixodes minor from both sites, which extends.

Soliman *et al*. (2001) found three mites *Ornithonyssus bacoti*, *Radfordia ensiifera* and *Laelaps nuttalli* and three fleas, *Echidnophaga gallinacea*, *Leptopsylla segnis* and *Xenopsylla cheopis*, on *Rattus rattus* and *R. norvegicus* in Sharkiya Governorate, Egypt.

Nava *et al.* (2003) collected 1,022 ectoparasites and recorded three new ectoparasite-host associations from Fifty-five rodents were captured from January 2000 to March 2001 in northeastern Buenos Aires Province, Argentina; ectoparasites were mites, ticks and fleas.

Khokhlova *et al*. (2004) collected two different flea species, *Xenopsylla conformis mycerini* and *Xenopsylla ramesis*, from *Meriones crassus*.

Stojcevic *et al.* (2004) collected three species of lices *Poliplax spinulosa* 14.5%, *Trimenopon jennings* and *Gyropus ovalis* 4.7%, and two species of fleas *Leptopsylla segnis* and *Ceratophylus fasciatus* 13.3% of rats trapped in rural regions of Croatia.

Beldomenico *et al*. (2005) found that *Ixodes loricatus* has long been considered with strict-total specificity to New World Marsupials. However, frequent findings of its immature stages on rodents suggest that these vertebrates play an important role in the tick's life cycle. Aspects dealing with the ecology of Sigmodontinae rodents infestation by *I. loricatus* are unknown. To contribute to the knowledge of the ecology of this tick species, environmental factors, as well as host species, sex and age, were evaluated to find associations of immature *I. loricatus* infestation of the most abundant wild rodent species from riparian locations of Buenos Aires province (Argentina).

Shaya and Rafinejad (2006) collected 218 ectoparasites belonging to 3 orders, 6 families, 6 genera, and 7 species from 24 localities in six major land-resource areas in Korram-Abad, Lurestan Province, Iran during the year of 2002-2003. Fleas with 3 species had the most number of species, mites and lice allocated the most (64.67%) and the least (3.21%) frequency of ectoparasites, respectively. Ectoparasites were more prevalent in Zagheh area (38.99%). *Haemolaelaps glasgowi* (42.2%) was the most common ectoparasite while, *Nosopsyllus irranus* only constituted approximately 0.91% of specimens.

Reeves *et al*. (2007) collected 616 tropical rat mites (*Ornithonyssus bacoti* (Hirst)) from rats (*Rattus norvegicus* (Berkenhout) and *R. rattus* (Linnaeus)) throughout 14 governorates in Egypt.

Telmadarraiy *et al*. (2007) in a plateu and mountanous areas in Iran, collected 9 species of ectoparasites including 3 fleas (*Pulex irritans, Xenopsylla buxtoni* and *Nosopsyllus medus*), one sucking lice (*Polyplax spinolosa*), two ticks (*Rhipicephalus* sp. and *Hyalomma* sp.), and 3 mites (*Lealaps nuttalli, Dermanysus sanguineus* and *Ornithonussus bacoti*), from *Microtus socialis, Mus musculus, Rattus rattus, Nesokia indica, Meriones persicus* and *Tatera indica*.

Matthee and Ueckermann (2008) described *Androlaelaps rhabdomysi* as a new species from the pelage of the endemic rodent *Rhabdomys pumilio* (Sparrman) in the Western Cape Province, South Africa.

Kia *et al*. (2009) found that, flea and lice had the most and the least frequency, respectively, among all collected arthropods. Nearly all rodent species were infested with *Xenopsylla*.

Matthee and Krasnov (2009) found that seven ectoparasite species (fleas *Chiastopsylla rossi* and *Dynopsyllus ellobius*, a louse *Polyplax arvicanthis*, mites *Androlaelaps fahrenholzi* and *Laelaps giganteus* and two ticks *Haemaphysalis elliptica* and *Hyalomma truncatum*) were exploiting the same populations of the rodent host *Rhabdomys pumilio* in South Africa.

Omudu and Ati (2010) found that the ectoparasites, collected from *Rattus rattus*, *M. natalensis*, *M. musculus* and *R. norvegicus* from residential buildings in Makurdi, Nigeria, comprised ticks *Haemophysalis* and *R. sanguineus* species (74.3%), fleas *Xenopsylla* species (31.3%), lice *Polyplax* species (69.3%) and mites *Dermanyssus* and *Myocoptes* species (71.9%).

2. Control studies:

2.1. Control of animal ectoparasites:

Thomas and Niels (1990) found that several formulations of Permethrin are effective acaricides against ectoparasites of rodents and other animals, in the wild or in laboratory and commercial settings. Many of the features of this acaricide, including its low degree of toxicity to the animals and their caretakers, make it more advantageous than other products and methods for controlling fur mites.

Wichai and Ching (1991) studied the insecticidal activity of Ivermectin compared with coumaphos against lice (*Haematopinus* spp.). Both display the same activity with regards to the ability to get rid of the external parasites. Parasite count results showed more significant reduction of ectoparasite in coumaphos and Ivermectin groups than the control. Ivermectin had more prolonged effect than comaphos.

Abo Elmaged (1998) found that spraying with Diazinon (2ml/L) and injection with ivermectin (200mg/kg) were more effective in curing sheeps and buffaloes mange. The mean time of recovery for infested sheep and buffaloes with mange ranged between 23-37 days, respectively.

Hussain *et al*. (2005) studied a variety of chemicals including trichlorophon (Neguvon), deltamethrin, flumethrin, ivermectin, doramectin, moxidectin, eprinomectin, abamectin, malathion, chlorinated hydrocarbons, cyhalothrin, cypermethrin, neguvon and tiguvon to control lice in cattle and buffaloes. Among these insecticides and antiparasiticides, ivermectin had been found to have maximum control over the infestation.

Sargison (2005) found that Sheep scab is a highly contagious and rapidly progressive disease of sheep of all ages, caused by infestation with the non-burrowing mite *Psoroptes ovis*.

Makeri *et al*. (2007) studied the effect of topical application of neem seed extract against the tick *Ablyomma variegatum* on sheep. The seed extract showed acaricidal activity at 5.0, 2.5 and 1.0% concentration *in vitro*. The extract had no acaricidal activity *in vivo*. However, it showed a repellant activity against ticks at 5.0 and 2.5% concentration.

Wall (2007) found that Synthetic neurotoxic insecticides have provided over 50 years of potent parasite control; they are highly effective, easy to apply and relatively inexpensive.

Leemon and Jonsson (2008) bioassayed thirty-one isolates of *Metarhizium anisopliae* against the cattle tick *Boophilus microplus*. More than half of these isolates showed a high degree of virulence to ticks.

Ramzan *et al*. (2008) evaluate and compare the efficacy of ivermectin, doramectin and *Azadirachta indica* (neem) leaves against tick infestation in cattle in Dera Ghazi Khan (Pakistan). They found that the efficacy of ivermectin, doramectin and *Azadirachta indica* (neem) against ecto parasites was 100%, 60% and 0%, respectively. From this study it was concluded that ivermectin is drug of choice against ecto-parasites of cattle.

Hosking and George (2009) in Australia, studied the efficacy of CLiK® Spray-On (50 g/L dicyclanil) in protecting unmulesed sheep from naturally occurring blowfly strike. Unmulesed sheep were treated on day 0 and inspected for fly strike at defined intervals thereafter. They found that CLiK Spray-On protected unmulesed Merino and cross-breed sheep of various ages and wool lengths for the Australian registered protection period of 18-24 weeks, which had been previously determined using only mulesed animals.

Khater *et al*. (2009) .Studied the effects of five essential oils against the buffalo louse, *Haematopinus tuberculatus*, and flies infesting water buffaloes in Qalyubia Governorate, Egypt. They found that all treated lice were killed after 0.5– 2 min, whereas with d-phenothrin, 100% mortality was reached only after 120 min. The number of lice infesting buffaloes was significantly reduced 3, 6, 4, 6 and 9 days after treatment with camphor, peppermint, chamomile, onion, and d-phenothrin, respectively. Moreover, the oils and d-phenothrin significantly repelled flies, *Musca domestica*, *Stomoxys calcitrans*, *Haematobia irritans* and *Hippobosca equina*, for 6 and 3 days post-treatment, respectively.

Natala and Ochoje (2009) questioned people about the pesticides, which used to control ectoparasites of farm animals in Zaria and Kaduna towns and their environs in Kaduna State, Northern Nigeria. Information was gathered from a total of 22 veterinary drug stores, 14 farms and 8 veterinary clinics were visited. A total of 28 different pesticides were encountered in veterinary drug stores, with synthetic pyrethroids (50%) being predominant. On the farms and veterinary clinics, 19 different pesticides were encountered, with organophoshates (42.1%) being the most widely used. The most popular method of application of pesticides was dipping.

2.2. Rodent control:

2.2.1. Attractant and repellent baits:

Jacobson (1986) stated that *Azadirachta indica* has been used for a long time in many fields, and showed many benefits for agricultural and industrial application. In agriculture, neem extracts of the seeds, kernels and cake have a potential role in controlling pests. They are natural resources, which are effective against a broad spectrum of insect pests. They act as a repellent, phago-deterrent and antifeedant.

Burwash *et al*. (1998) evaluated eight synthetic predator odors and mongoose *(Herpestes auropunctatus)* feces for eliciting avoidance responses and/or reduced feeding by wild captured Hawaiian roof rats *(Rattus rattus).* They found that rats displayed a response to the predator odors in terms of increased elapsed time before initial arena entry and initial eating bout, a lower number of eating bouts, and less food consumption than in the respective control groups.

Dielenberg and McGregor (1999) studied the efficacy of predatory odors avoidance for rodents. Results showed that rats exposed to the cat collar displayed a robust avoidance response, spending about 70% of a 20-min session in the hide box compared to 25% in control rats .This avoidance response was completely reversed in rats given a low dose (0.375mg/kg) of midazolam. During the test phase, rats exposed to the cat odor on the previous day showed elevated levels of hiding when returned to the test apparatus without the cat odor present.

Khan *et al*. (2000) studied field trials on four field rodents *viz.*, *Bandicota bengalensis*, *Millardia meltada*, *Mus musculus* and *Nesokia indica* to control their populations in rice crop by improving poison bait acceptance using the additives *viz*., minced meat, egg-yolk, egg-shell and yeast.

Boeke *et al*. (2004) found that the neem tree, Azadirachta indica, provides many useful compounds that are used as pesticides and could be applied to protect stored seeds against pests.

Witmer *et al*. (2008) investigated 18 commercially available materials for their attractiveness to wild Norway rats in a pen study. The most promising candidate attractants, based on the number of station visits, were anise, almond, ginger, and lemon extracts.

2.2.2. Rodenticides:

Abdel-Gawad and Farghal (1982) in the central hospital in Assiut of Egypt, found that *A. niloticus* was more susceptible to Warfarin (0.04%) than *R. norvegicus* in all maturity stages (early, medium and mature).

Helal and Zedan (1982), in Assiut Governorate of Egypt, used Difenacoum at 0.005% against *R. norvegicus* and *R.r. alexandrinus*. They found that the LT_{50} and LT_{95} values were 5.5 days and 21 days.

Ali (1991) in Sohag Governorate of Egypt, studied efficacy of anticoagulant rodenticides using multiple feeding for 6 days under field condition. He found in multiple doses that Racumin and Matikus have the highest percentage of rodents control success 98.5% and 95% consequently.

Asran *et al.* (1992) evaluated the efficacy of 6 anticoagulant rodenticides against Nile grass rat, *A. niloticus*. Results indicated that 0.005% Flocoummafen, 0.005% Brodifacoum anticoagulants were the most effective ones followed by 0.005% Diphacinone, 0.006% Chlorophacinone, 019% Sulphaquinoxaline, 0.005% Bromadiolone and 0.05% Warfarin. The reduction caused by the above mentioned six rodenticides were 91.2 %, 85.4%, 82.8%, 76.8% and 64.2%, respectively.

Gill (1992) in UK, determined the toxicity of the anticoagulant Flocoumafen to three universal commensal rodent pest species, *R. norvegicus*, *R. rattus* and *Mus domesticus* and four tropical rodent species not native to UK, *Meriones shawi*, *Acomys cahirinus*, *A. niloticus* and *Mesocricetus auratus*. In the 1-day no-choice tests, Flocoumafen gave 97.5% mortality of Warfarin-resistant laboratory rats, 100% mortality of Difenacoum-resistant rats, 92% mortality of *R. rattus*, 75% mortality of warfarin-resistant *M. domesticus* Linn., and 100% mortality of *A. niloticus*.

Parshad and Malhi (1995) in India, studied the efficacy of Racumin to three species of South Asian rodents**,** *Bandicota bengalensis*, *Tatera indica* and *Rattus rattus* in laboratory and field experiments. Species-specific differences occurred between the efficacy of 0.75% Racumin tracking powder (RTP) used for contact poisoning, and 0.0187, 0.0375 and 0.075% Racumin baits (RB), prepared by mixing the concentrate with cracked wheat, powdered sugar and peanut oil (96:2:2), used for poison baiting. *B. bengalensis* was most susceptible to the toxic effects of Racumin as both RTP and RB caused 80–100% mortality after short exposures (15 min and 3 h) to a floor/runway treated with 1 g/rat of RTP in forced contact and simulated runway techniques and 1–2 days of choice feeding of 0.0187 and 0.0375% RB in feeding tests. These treatments were less effective against *T. indica* and least effective against *R. rattus*. In pen experiments, in which the runway was treated with 2g of RTP, 100 and 60% mortality from groups of 5 rats each of *B. bengalensis* and *T. indica* occurred, respectively.

Vaziri and Farid (1995) in Iran, studied the efficacy of the rodenticides, Bromadiolone 0.005%, Chlorophacinone 0.006% plus Sulphaguinoxaline 0,019% against *Rattus norvegicus* and *Nesokia indica* under field conditions. The results showed that Bromadiolone gave 88.4% mortality of *Nesokia indica* in Karaji and 90.13% mortality in Djiroft. However, Chlorophacinone plus sulfaquinoxaline gave 86 and 85.15% mortality, respectively, in these areas.

Chander-sheikher *et al.* (1996) tested the rodenticide baits containing Zinc phosphide 2.5%, Bromadiolone 0.005%, Flucoumafen 0.00% and Cholecalciferol 0.075. Results indicated that the above mentioned rodenticides were most effective when applied through burrow baiting, leading to a 61.11, 83.64 ,84.61 and 36.36% reduction in the number of active burrows, respectively.

Khan *et al.* (1998) used both acute and anticoagulant baits against *Bandicota bengalensis* and *Nesokia indica*. The results showed that the efficacy of three formulations of 2% zinc phosphide in reducing rodent activities were 97.5%, 96.7% and 95.2% for wax coated cake, grain, and plain cake respectively. Meanwhile, the treatments with wax blocks of 0.005% Brodifacoum and 0.037 % coumatetraly gave 98.8% and 98.95% mortality, respectively.

Moran (1999) used wheat grain bait, treated with sodium fluoroacetate, and is used to control field rodents in Israel

Hygnstrom *et al*. (2000) in USA, studied the efficacy of in- furrow applications of 2% Zinc phosphide at planting for control of rodent damage in no-till corn, in three independent field. The population in the most severely damage fields ranged from 104 to138 active colonies / ha. Zinc phosphide reduced yield loss in the three studied areas by 7-34%.

Farghal *et al*. (2000) in Qena Governorate studied the toxicity of three anticoagulant i.e. Farobaid, Caid and Supercaid against *A. niloticus* under field conditions. Farobaid gave complete control to *A. niloticus* inhabited tomato field after 20 days of treatment. The LT50 and LT95 values were 3.1 and 21 days. Supercaid reduced 77.3% of *A. niloticus* population in sugarcane field after 21days of treatment, with LT50 and LT95 values of 8.2 and 43 days. Caid gave 59% reduction in *A. niloticus* inhabited sugarcane after 20 days of treatment. The LT50 and LT95 values were 16 and 100 days. The acute rodenticides, Quintox reduced 70% of *A. niloticus* population in corn field after 20 days of treatment. The LT50 and LT95 values of 10 and 82 days. Storm completely eradicated *R. norvegicus* after 6 days of offering poisoned baits. The LT50 and LT95 values were 4.4 –6.0 days in 1995 and 4.0 – 5.8 days in 1996.

Shehab *et al*. (2000) in Syria, studied the efficacy of the poisoned bites prepared by mixing 95.5g bite base (water added until 40% moisture) + 2g vegetable oil + 2.5% Zinc phosphide. The results showed that the reduction in the active burrows, after 24 hour of treatment, were: 83.97% and 81.86% for grains of wheat and corn, However, the other bite bases were 74.95%, 65.13%, 58.78%, respectively.

Abdel-Gawad (2001a) in Assiut Governorate of Egypt, studied the rodent control in the student buildings of Assiut University during ten successive years from 1991 to 2000. Zinc phosphide 3% was used through July as quick acting poison outside the buildings one time during the first year to reduce the high density of rodents. The anticoagulant rodenticide, Retak (Difenacoum0.005%) followed the treatment of Zinc phosphide twice a year one during February and the other through July month, outside and inside the building.The reduction in rodent population after the treatment with Zinc phosphide was 76.8% from the initial population. The decrease in rodent density during the years of study which treated with anticoagulant rodentcide was about 69.8% during 1994, 80.7% in 1995 and 1998.

Oconnor and Booth (2001) in New Zealand, studied the sensitivity of four rodent species include *Ratus norvegicus*, *R. rattus*, *R. exulans* and *Mus musculus* Linn., to brodifacoum. Results indicated that the LD_{50} in rodents ranged from 0.17 mg/kg to 0.52 mg /kg.

Twigg *et al.* (2002) used 2.5% Zinc phosphide wheat bait in dry storage against house mice in the canola in the central wheat belt region of western Australia.

Donlan *et al*. (2003) tested brodifacoum and two less toxic rodenticides, diphacinone and cholecalciferol, in eradicating *Rattus rattus* from three small islands in the northern Gulf of California, Mexico. All three rodenticides were successful in eradicating rats, suggesting that the less toxic diphacinone and cholecalciferol may be useful alternatives to brodifacoum for some island eradication programs.

Eisemann *et al.* (2003) in USA, studied the utilizing of Zinc phosphide as population control against the Norway rat, roof rat and house mouse. The efficacy of Zinc phosphate under laboratory and field condition have been conducted against the three species of mice, *Peromyscus mainiculatus*, *Acomys cahirinus*, *Mus musculus* Linn. The efficacy rate for mouse control using ZP was higher than 70% in all studies.

Moran (2003) in Israel, tested Cholecalciferol whole wheat bait in no-choice laboratory experiments as rodenticides for the field rodent species Microtus guentheri and Meriones tristrami. The LT50 was 40.86 and 32. 17 days for both species, respectively.

Shriprakash *et al.* (2003) studied the efficacy of baits formulated with two acute rodenticides, Uoroacetamide and Zinc phosphide and two second generation anticoagulants, Bromodialone and Difethialone at diferent concentrations against laboratory-bred wild type rats, *Rattus rattus* (Linn.). The mortality data clearly indicated that Uoroacetamide was more effective than Zinc phosphide at all three concentrations and produced complete mortality at 2% and 3%. In contrast, the Zinc phosphide bait did not show appreciable mortality and caused lower bait acceptance and palatability. The mortality patterns were significantly different and there were decrease in mortality caused at some concentrations. Bromodialone admixed cereal-based bait did not cause any deference mortality pattern among rats. However, the mortality pattern was inurned by concentration and duration of exposure. Bromodialone at the higher concentration (0.0075%) showed less effectiveness than at 0.005%, which caused 100 % mortality after 96 h exposure.

Prakash *et al. (*2003) evaluated the bio-efficacy of cereal-based bait formulated with two acute rodenticides, fluoroacetamide and zinc phosphide and two second generation anticoagulants, bromodialone and difethialone at different concentrations against laboratory-bred wild type rats, *Rattus rattus*. Bait containing 2% fluoroacetamide and incorporating edible green colour 0.025% and human feeding deterrent denatonium benzoate 0.001% produced complete mortality in 6 days and was considered to be the most effective.

Johnston *et al.* (2005) in California found that efficacy of zinc phosphide-coated baits and sugar-enhanced rolled oat based zinc phosphid bait with pre-baiting gave 100 and 60% mortality, respectively.

Kaur and Parshad (2005) in South Asia studied the efficacy of 0.0375% Racumin to control the lesser bandicoot rat, *Bandicota bengalensis*. The results showed high success in rice and wheat cropping.

Ahmed (2006) in Assiut Governorate of Egypt found that the application of Zinc Phosphide singly was the superior in controlling rodents, while supercaid only had lowest effect. Whereas, using both rodenticide together achieved a moderate effect.

Baghdadi (2006) found that the Bromadilone 0.005% was more effective than Brodifacoum 0.004%in controlling *Arvicanthus niloticus*.

El-Saady (2009) found that zinc phosphide surpassed racumin and tomorin in killing *rattus rattus alexandrinus*. This rodenticide was faster, whereas the highest reduction of density was observed within one day after application giving a mean value of 78.8% reduction. The bait consumption disappeared in the 3^{rd} day of application with zinc phosphate while with racumin and tomorin the bait consumption gradually reduced and the completely nonconsumption was attained after 18 and 21 days of application , respectively, more than 50% reduction in rat density was observed in the 6^{th} and 12^{th} days from application with racumin and tomorin, respectively. The estimated LT_{50} was less than one day with zinc phosphide. The LT_{50} with rocumin were 5.20 days, and Tomorin came in last whereas the LT_{50} was 7.98 days.

MATERIALS AND METHODS

The present study was conducted in the farm animals of the Faculty of Agriculture, Assiut University, during three years, starting from December 2007. This farm consisted of about five feddans, including the buildings of animal- sheds and animal food storages. This farm contains buffaloes, cattle and sheep. The present survey of ectoparasites included both ectoparasites associated with animals and rodent species in addition to the pests collected from animals manure in the ground of the farm, during the study period. The present work was done to study the following topics:

1. General survey of pests inhabiting farm animals in the area of study:

1.1. Rodents:

Twenty wire-box traps were baited and distributed twice every week at 6 pm and collected at 7 am. The captured rodents were classified and recorded. The percentage of each species was estimated during the survey period.

1.2. Flies:

Flies were collected by using a sweeping net (handle, 80cm long, hoop 28 cm in diameter, Egyptian white cloth bag 80 cm depth). Samples were taken twice each week through fly activity inside and outside door. Flies were anaesthetized by chloroform and transferred to the laboratory for identification.

1.3. Mosquitoes:

A 100-150 ml of water was taken weekly at a depth of 10 cm of the pool, and put in plastic containers, then transferred to the laboratory for further identification.

2. Survey and population density of animal ectoparasites:

2.1. Animals ectoparasites:

Samples were taken once weekly from five regions of the animal body chosen to the study. Samples were individually anaesthetized in a jar containing a cotton pad moistened with chloroform, then brushed in a deep white plate using a relatively hard brush. Collected ectoparasites were preserved in plastic tubes containing 70% ethyl alcohol and labeled with necessary information for identification.

2.2. Animal manure pests:

Samples were taken ten times each month during two successive seasons, 2008 to 2010 from soil of rodent burrows, cattle and sheep at Experimental Farm of Assiut University. Soil samples were preserved in plastic bags labeled with necessary information and then transferred to the laboratory for extraction and identification. Extraction was carried out using the modified Berlese's extractor apparatus. After extraction of the whole fauna in the samples, arthropods were isolated in small vials then counted by using a stereoscopic binocular microscope. Clearing of collected specimen was done using lactic acid and higher technique was used for mounting of mites. Mites were mounted and left to dry by using a hot plate and prepared for microscopic examination. Identification of mites and ticks was done using different keys constructed by **Hoogstraal and Kaiser (1958)**, **Zaher (1986a and b) and Evans (1992).**

2.3. Associated rodents in animal-farm:

Rodents were collected alive and classified to species and subspecies, male and female of each as well as the distribution frequency of each species (%) was estimated. For collection of ectoparasites, rodents were individually anaesthetized in a jar containing a cotton pad moistened with chloroform then brushed in a deep white plate using a relatively hard brush. After collecting the ectoparasites, they were preserved in plastic tubes containing 70% ethyl alcohol and labeled with necessary information. The ectoparasites were classified as fleas, lice, mites and ticks. From the whole fauna in the sample, mites were isolated in small vials using a Camel's hair brush to avoid destruction and counted using stereoscopic binocular microscope. Clearing of collected specimens was done using lactic acid. Mites were mounted in Hoyer's media and left to dry by using a hot plate and prepared for microscopic examination. Identification of mites was done using different keys constructed by **Karg (1971), Hughes (1961 and 1976) and Krantz (1978).**

3. Control of ectoparasites in farm animal:

3.1. In animals:

3.1.1. Sheep fleas:

Animal was virtually divided into five groups. The infested group was isolated in special places to prevent spreading of the ectoparasites and was divided into equal subgroups; one was treated with Diazinon 60% EC spray, Vertimec 1.8% EC, Butox 5% EC at the concentration of 1cm/liter, and the second group was treated by Radiant 12% SC at the concentration of 4, 6 and 8 ml/liter. Treatments were compared with the control group; the results were taken after 1, 3, 5, 7, 10, 15, 20, 25, 30 and 45 days.

3.1.2. Buffalo lice and cattle ticks:

Animal was virtually divided into five groups. The infested group was isolated in special places to prevent spreading of the infestation and divided into equal subgroups; first group was treated with Diazinon 60% EC spray, Vertimec 1.8% EC, and Butox 5% EC at concentration of 1, 1.5 and 2 ml/ liter .The second group was treated by Radiant 12% SC at the concentration of 4, 6, 8 and 12 ml/ liter. Results of aforementioned compounds were compared with Ivermectin 1% injection, 1 ml / 50 kg of animal as a control agent of ectoparasites in the farm. Treatments were compared with the control group; the results were taken after 1, 3, 5, 7, 10, 15, 20, 30 and 45 days.

3.1.3. Buffalo and sheep mange:

Infested spots with *Sarcoptes* were sprayed with Diazinon 60% EC spray, Vertemic 1.8% EC and Butox 5% EC at the concentration of 1 cm/liter, Radiant 12% SC 6 cm/liter. Tincture iodine 4% and Sulfur with vaseline 10% were evaluated during the study along with Ivermectin 1 ml injection / 50 kg of animal to control scabies in the farm. The results were taken after 1, 3, 5, 7, 10, 15, 20, 30 and 45 days.

3.2. Animal manure:

3.2.1. Mechanical control:

Five samples were taken after each treatment of cleaning and burning of sheep soil. Soil of the experiment was covered with Quicklime, which was turned to be $Ca(oH)_2$. Fleas were recorded and compared with which in the control samples of sheep soil. The results were taken after 1, 3, 5, 7, 10, 15, 20, 25, 30 and 45 days.

3.2.2. Chemical control:

Each pesticide was sprayed on five regions of manure infested with fleas larvae in sheep farm and then compared with the control group. Pesticides were: Diazinon 60% EC spray, Vertimec 1.8% EC, and Butox 5% EC at the concentration of 2 cm/liter and Radiant 12% EC 4 ml /1 liter. The results were taken after 1, 3, 5, 7, 10, 15, 20, 25, 30 and 45 days.

3.2.2.1. Flies larvae:

Each pesticide was sprayed on five regions of manure contained flies larvae in farm animal and then compared with the control regions. The pesticides were: Diazinon60% EC, Vertimec1.8% EC, and Butox 5% EC at the concentration of 1cm/1liter water and the second region was treated by Radiant 12% EC 4cm/1liter water and Quicklime. The results were taken after 1, 3, 5, 7, 10, 15, 20, 25 and 30 days.

The percentage of reduction in the population density of animal parasites were computed according to the formula given by **Henderson and Tilton (1955).**

$$\% \text{ Reduction} = 1-[(C1/T1) \times (T2/C2)] \times 100$$

Where,

C1= pre-treatment population density in control habitat.

C2= post treatment population density in control habitat.

T1= pre-treatment population density in treated units.

T2= post treatment population density in treated units.

4. Rodent control:

<u>4.1. Under laboratory condition</u>:

4.1.1. Attractant and repellent baits:

Rodents were trapped and transferred to the laboratory; healthy mature males and females of *Arvicanthis niloticus* (120-150g), *Rattus rattus frugivorus*(180-200g) and *Rattus rattus alexandrinus*(160-190g) were chosen for these tests. The animals were singly caged and suitably accommodated in the laboratory for two weeks, then provided with crushed maize bait and water. Ten animals (5 from each sex) of rodent species were selected for study.

Four kinds of foods used in the preference test, which were Cumin, coriander, anise and yeast. For all experiments, 50 grams of each were mixed with crushed maize and provided in each food, and free crushed maize introduced to the control group. The consumption was recorded daily for each animal and each kind of food on five days period. The position of the cups inside the cage was changed daily to avoid baits of position preference.

The same method was carried out with black pepper, jojoba seed, oshar leaf powder and neem leaf powder as repellents.

4.1.2. Toxicity of two-anticoagulant rodenticides to certain rodent species:

Rodents were trapped and transferred to the laboratory, healthy mature males and females of *Arvicanthis niloticus* (120-150g), *Rattus rattus frugivorus*(180-200g) and *Rattus rattus alexandrinus*(160-190g) were chosen for the tests. Animals were singly caged and suitably accommoded in the laboratory for ten days and provided with enough wheat bait and water. For each of the two tested rodenticides (Supercaid 0.004% and Caid 0.005%), five males and five females were selected; the consumption was recorded daily for each animal and for each kind of food on five days period. The daily poison bait consumed for each animal was recorded. The poison bait was replaced by bait in cages.

4.2. Under field conditions:

4.2.1. Toxicity of rodenticides:

Three areas of farm animal were selected to conduct chemical control. The first area was treated with the common anticoagulant rodenticide, Supercaid 0.004% with crushed maize by distributing 10-paper bait stations containing 200g poison bait .The second area has 10-paper bait stations from Caid 0.005% with crushed maize. The reduction of rodents was estimated by trapping methods and compared with the control group (third area), the experimental lasted for 11days.

4.2.2. Acceptability of rodent species for two attractive baits:

The field trial was carried out in the experimental faculty farm in three areas. In each, replicate 5 paper bait stations for Supercaid 0.004%. Supercaid 0.004% with vanilla and Supercaid 0.004% with yeast, each station treated with 200 gm poison bait. The position of the baits stations was daily changed to avoid the shyness. The consumption of baits was daily estimated in each station to the nearest gram, the experiment lasted for 6 days.

4.2.3. Toxicity by aluminum phosphide 33%:

Aluminum phosphide was evaluated against rodents under field conditions based on reduction in the active burrows. In three areas for each treatment, 20 active burrows were marked. A distance of 200 m was left between each treatment and the others. The fumigation tablets were distributed into the active burrows. On the other hand, 20 active burrows were marked as a control; the percentage of rodent active burrows was recorded two times every week. The experimental lasted for one month.

5. Data Treatment and Statistical by Analyzed:

Simple correlation was conducted between ectoparasite populations and weather factors to identify the role of those factors in distributing the population.

Data were analyzed using analyses of variance **(MSTAT-C 1988)** and means were separated using the least significant differences method (LSD) at 5% probability level **(Steel and Torrie, 1984),** only when a significant "F" test was obtained. The percentage of reduction was calculated by **Henderson and Tilton (1955)**. All percent mortality data were arcsin transformed to suit the analysis.

6. Pesticides:

The common names, chemical group and chemical structures of the rodenticides used in the toxicological and control studies are:

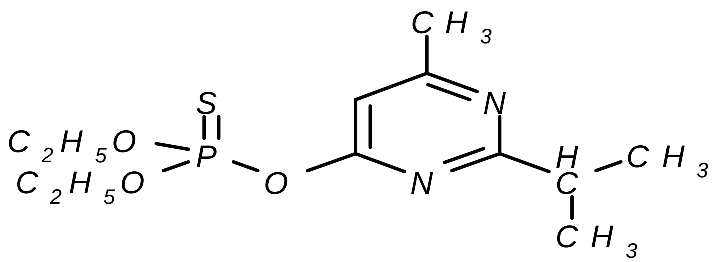
1. Diazinon 15 % and 60% EC

Common name (diazinon)

Chemical group: Organophosphate

Used method: Spraying

Chemical structure



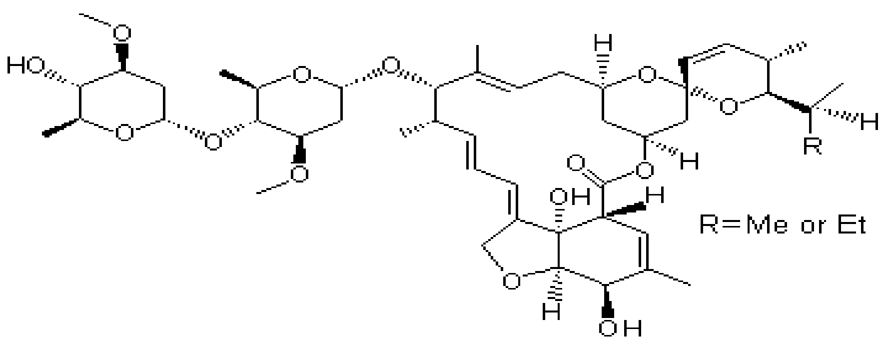
2. Vertimec1.8% EC

Common name (abamectin)

Chemical group: macrocyclic lactone (Avermectins)

Used method: Spraying

Chemical structure



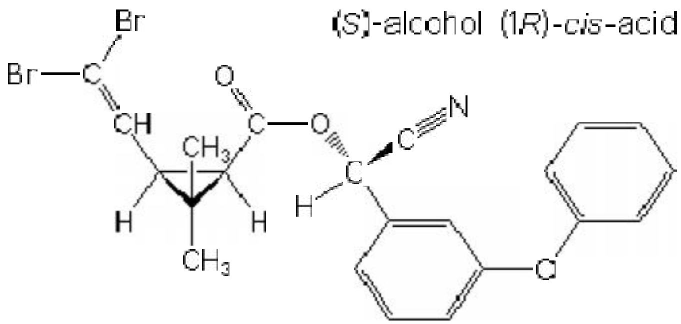
3. Butox 5%EC

Common name (deltamethrin)

Chemical group: Synthetic Pyrethroid

Used method: Spraying

Chemical structure



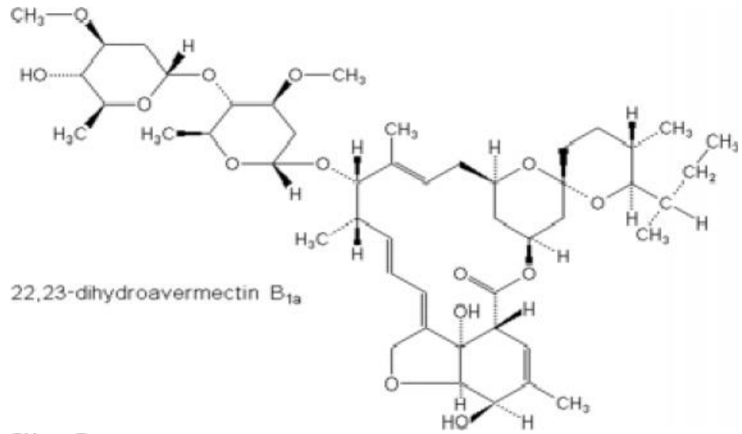
4. Ivomec 1% L

Common name (ivermectin)

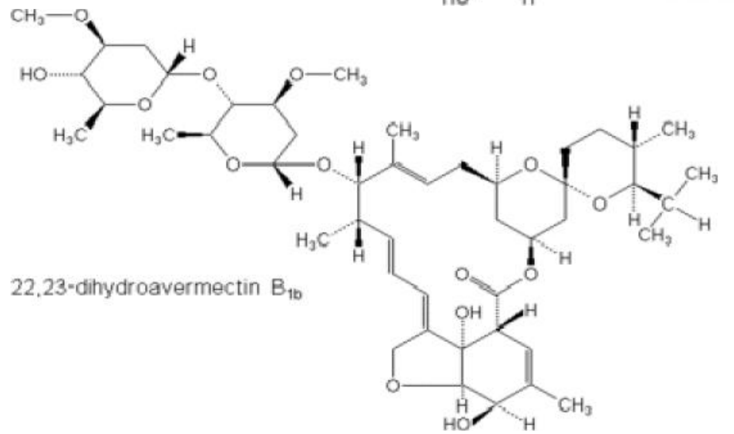
Chemical group: macrocyclic lactone (Avermectins)

Used method: Injection

Chemical structure



22,23-dihydroavermectin B_{1a}



22,23-dihydroavermectin B_{1b}

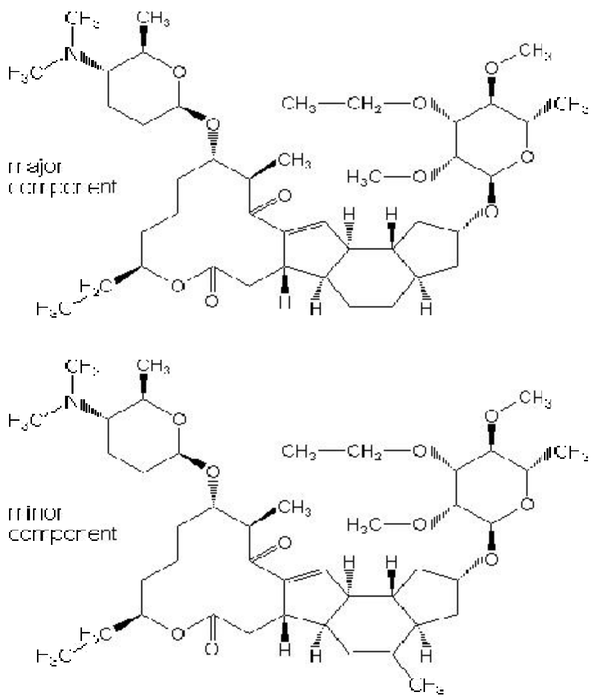
5. Radiant 12% SC

Common name (spinotrame)

Chemical group: Synthetic pyrethroid

Used method: Spraying

Chemical structure



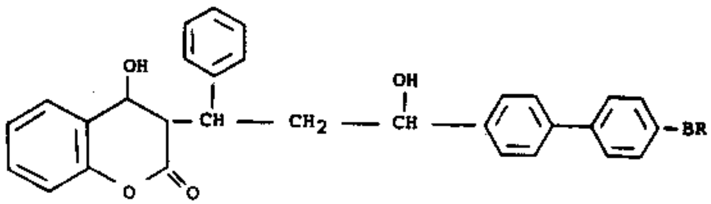
6. Supercaid 0.004%

Common name (bromodialone)

Chemical group: Coumarine

Used method: Bait

Chemical structure



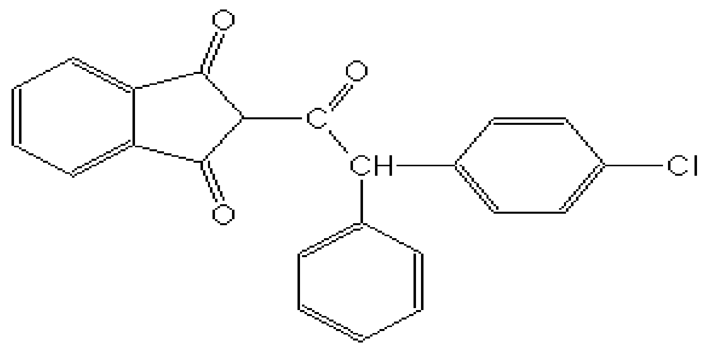
8. Caid 0.005%

Common name (chlorophacinone)

Chemical group: Indandione

Used method: Bait

Chemical structure



9. Aluminum phosphide 33%
Used method: fumigation

Chemical group: Inorganic compound

Chemical structure: Alp

CHAPTER (2)

STUDIES ON CERTAIN ECTOPARASITES ASSOCIATED WITH SOME FARM ANIMALS AND THEIR CONTROL

RESULTS AND DISCUSSION

1. General survey of pests inhabiting farm animals in the area of study:
2. Survey of ectoparasites

3-Population density of ectoparasites

RESULTS AND DISCUSSION

1. General survey of pests inhabiting farm animals in the area of study:

1.1. Rodents:

Data in Table (1) and figure (1) show the species of rodents trapped from farm animal of Assiut University during the period from 2007 to 2010 years. The white bellied rat, *Rattus rattus frugivorus* (Linnaeus), the grey bellied rat, *Rattus rattus alexandrines* (Linnaeus), and the Nile grass rat, *Arvicanthis niloticus* (Desmarest).

R. r. frugivorus was recorded the highest dominant percentage (67.71% and 56.40%) followed by *R. r. alexandrines* (26.04% and 30.05%) and *A. niloticus* was (6.25% and 13.55%) during the first and second years, respectively. This may be due to the presence of more preferable trees for nesting and feeding. In the third year, *A. niloticus* occupied the highest dominant percentage (38.36%) followed by *R. r. frugivorus* (30.95%) and *R. r. alexandrines* (30.69%). This may be due to the availability of food in neighbored field crops and vegetable plantations in faculty Farm. Embarak (1997) recorded three species of rodents in the cultivated area in Assiut Governorate, *R.r.frugivorus* (45.05%), *A. niloticus* (31.71%) and *R.r.alexandrinus* (26.24%). While in a semi-arid area, *R.r.frugivorus* represented (53.34%) and *A. niloticus* represented (46.51%), while *R.r.alexandrinus* was not encountered .

Generally, the data represent three dominant species of rodents, the white bellied rat, *R. r. frugivorus* that represented 52.86% of population, followed by the grey bellied rat, *R. r. alexandrinus* that represented 28.74% and *A. niloticus* that represented 18.40%.

Generally, *R.r.frugivorus* was the most dominant species in the Faculty Farm in the first and second years, and that may be due to **several** factors e.g., intra-specific competition, fecundity increasing and in habitat the ecosystems in which poultry buildings established in the Faculty Farm **the**

presence of palm trees in the preparation of farm animal production, or **poultry farm nearby**, and **this provides shelter and also to an increase in feed stores, farm production**. This finding is in agreement with Ali (1985) and Abo Elmaged (1998) recorded five species of rodents *Mus musculus*, *Arvicanthis niloticus*, *Rattus norvegicus*, *Rattus rattus alexandrinus* and *Rattus rattus frugivorus*, in the animal farm of the faculty of Agric. Assiut University.

1.2. Flies:

Data in table (2) show that six species of flies and one species of mosquito were recorded in farm animal of Assiut University during 2008-2010. Biting and non biting species of recorded flies were belonging to four families during the course of the present work. These species were identified according as follows:

Family : Muscidae -1

Musca domestica Macq

Muscina canicularis Wied

Stomoxys calcitrans L.

Family: Tabanidae -2

Tabania sp. Merg.

Family: Sarcophagidae -3

Sarcophaga sp. L.

4- Family: Calliphoridae

***Phormia regina* Meig.**

The house fly, *Musca domestica* Macq was collected from the farm animal in high numbers during the two years as compared with the other species. The stable fly, *Tabania* sp. was recorded only in buffalo sheds, but the biting fly had never recorded in sheep farm, *Stomoxys calcitrans* was collected with considerable numbers from the buffaloes and cattle farms. *Sarcophaga* sp. and *Phormia regina* were recorded in comparatively low numbers through the two years in the area of study. These results may be due to mainly **the presence of organic matter in animal production farm,** the wholly, was in agreement with those obtained by Abo Elmaged (1998), Grabovac and Petrić (2003), Peter *et al*. (2006) and Mamabolo *et al.* (2009).

1. 3. Mosquitoes:

Data in the same Table (2) showed that a single species of mosquito (*Culex* sp.) was recorded in animal farm during 2008- 2010 at Assiut University. The same result was obtained by **Abo Elmaged (1998) and Alahmed (1998).**

2. Survey of ectoparasites:

2.1. In animals:

Data in Table (3) showed that the farm animals were infested by lice, fleas, mites and ticks during the period of study. Lice (*Haematopinus tuberculatus* L) were highly recorded in buffalo farm, but absence on cattle and sheep. The fleas were collected with high members from sheep farm and scarce from cattle, but absent in buffaloes farm. Buffaloes and sheep farms were slightly infested with mites, while no mites were found on cattle farm. Cattle were moderately infested with ticks. While mites were completely absent in the other two farms. These results were recorded also by **Bazarusanga *et al*. (2007), Tefera and Abebe (2007), Muhammad *et al*. (2008), Tasawar *et al*. (2008), Davoudi *et al*. (2008)**, **and Kakar and Kakarsulemankhel (2009)** in the farm animal.

2.2. In animals manure:

Data in Table (4) showed that the ectoparasite species collected from the soil of rodent burrows from the farm of the Faculty of Agriculture. The collected mite species were: *Amerosieus* sp., *Hypoaspis smithii*, *Glycyphagus* sp., and *Tarsonemus* sp., and one species of hard tick, *Haemaphysalis* sp., from the family Ixodidae, the single species of fleas

(*Xenopsylla cheopis*) and a single species of lice (*Polyplax spinulosa)* were also collected. Results showed also that, *Amblyomma* sp., *Haemophysalis* sp., *Pullex irritans and Xenopsyllae cheopis* were collected from cattle-sheds, while *Sarcoptes* sp., and *Xenopsyllae cheopis* were collected from sheep-sheds**. EL-Eraky and Shoker (1993)** recorded 28 species of Mesostigmata representing 9 families and 18 genera in the farm animal of the Faculty of Agriculture (Assiut, upper Egypt). Results also revealed the relationship between the parasite mites on rodents and mites on animals. This phenomena may explain the fact that rodents play an important role as a host and **a** mediator in transmitting mites to animals**.** *So*, the control of rodents in the animal production farm is recommended.

2.3. Rodents ectoparasites:

Data in Table (5) revealed the presence of some ectoparasites collected from rodent species in the farm of the Faculty of Agricultural. The collected parasites were: eight species of mites (*Amerosieus* sp., *Hypoaspis smithi*, *Ornithonyssus bacoti, Rhizoglyphus echinopus, Glycyphagus* sp., *Myocoptes* sp., *Tarsonemus* sp., and *Cheyletus zaheri*) belonging to eight families of mites. Two species of hard ticks were also found (*Amblyomma* sp., and *Haemaphysalis* sp.) pertaining to the family Ixodidae. Three species of fleas (*Xenopsylla cheopis, Leptopsylla segnis, Pulex irritans*) and two species of lice (*Polyplax spinulosa, Haplopleura oenonydis)* were collected from the same rodent species. The results show also that, *Haplopleura oenonydis, Pullex irritans, Hypoaspis smithii* and *Amblyomma* sp., were collected only from the body of *R.r. alexandrinus,* and absented from *R.r.frugivorus* body. The *Amerosieus* sp., and *Haemaphysalis* sp., were collected from *Arvicanthis niloticus*, but absented from *R.r. alexandrinus***.** Data in the present study were in agreement with those obtained by **Abdel-Gawad and Maher Ali (1982), Embarak (1997)**, **Nava *et al*. (2003) and Shayan and Rafinejad (2006**) who found the same ectoparasites collected from the body of rodent species.

Table (1) Survey of rodent species in farm animals of the Faculty of Agriculture, Assiut University, during, 2007-2010.

Species / years	*R.r. frugivorus*	*R.r. alexandrinus*	*A. niloticus*
	%	%	%
2007-2008	67.71	26.04	6.25
2008-2009	56.40	30.05	13.55
2009-2010	30.95	30.69	38.36
Grand mean	52.86	28.74	18.40

Table (2) Survey of insect species in farm animals of the Faculty of Agriculture, Assiut University, during, 2008-2010.

Animal farm / Species	Buffalo farm	Cattle farm	Sheep farm
Musca domestica	+++	+++	+++
Muscina canicularis	++	++	+
Tabania sp.	++	-	-
Stomoxys calcitrans	+	+	-
Sarcophaga sp.	+	+	-
Phormia regina	+	+	-
Culex sp.	+	+	++

+++ = Heavily infested animals with insects, >100
++ = Moderately infested animals with insects, <50
+ = Slightly infested animals with insects, <20
- = None infested animal

Table (3) Survey of ectoparasites in farm animals of the Faculty of Agriculture, Assiut University, during, 2008-2010.

Farm animal / Arthropods	Buffalo	Cattle	Sheep
Lice	+++	-	-
Fleas	-	+	+++
Mites	+	-	+
Ticks	-	++	-

+++ = Heavily infested animals with parasites.
++ = Moderately infested animals with parasites.
+ = Slightly infested animals with parasites.
- = None infested animals.

Table (4) Survey of arthropods in animal-sheds of the Faculty of Agriculture, Assiut University, during, 2008-2010.

Arthropods / Animal sheds	Lice	Fleas	Mites	Ticks
Rodent burrows	*Polyplax spinulosa*	*Xenopsyllae cheopis* *Pulex irritans*	*Amerosieus* sp. *Hypoaspis smithii* *Glycyphagus* sp. *Tarsonemus* sp.	*Haemophysalis* sp.
Cattle sheds	----------	*Xenopsyllae cheopis* *Pulex irritans*	--------	*Amblyomma* sp. *Haemophysalis* sp.
Sheep sheds	----------	*Xenopsyllae cheopis*	*Sarcoptes* sp.	-----------

Table (5) Survey of rodent ectparasites in farm animals of the Faculty of Agriculture, Assiut University, during, 2007-2010**.**

Rodents / Ectoparasites	***R.r. frugivorus***	***R.r. alexandrinus***	***A. niloticus***
Lice	**Polyplax spinulosa**	**Polyplax spinulosa**	**Polyplax spinulosa**
	---------	*Haplopleura oenonydis*	---------
Fleas	*Xenopsyllae cheopis*	*Xenopsyllae cheopis*	*Leptopsylla segnis*
	Leptopsylla segnis	*Leptopsylla segnis*	-----------
	---------	*Pullex irritans*	-------------
Mites	**Mesostigmata**		
	Ameroseiidae *Amerosieus* sp.	------------	Ameroseiidae *Amerosieus* sp.
	Dermanyssidae *Ornithonyssus bacoti*	Dermanyssidae *Ornithonyssus bacoti*	----------------
	-------------------	Laelapidae *Hypoaspis smithii*	Laelapidae *Hypoaspis smithii*
	Astigmata		
	Acaridae *Rhizoglyphus echinopus*	Acaridae *Rhizoglyphus echinopus*	----------------------
	Glycyphagidae *Glycyphagus* sp.	Glycyphagidae *Glycyphagus* sp.	Glycyphagidae *Glycyphagus* sp.
	Listrophoridae *Myocoptes* sp.	Listrophoridae *Myocoptes* sp.	----------------

	Prostigmata		
	Cheyletidae **Cheyletus zaheri**	--------------	---------------
	Tarsonemidae *Tarsonemus* sp.	Tarsonemidae *Tarsonemus* sp.	Tarsonemidae *Tarsonemus* sp.
Ticks	-----------------	Ixodidae *Amblyomma* sp.	--------------
	Haemaphysalis sp.	--------------------	*Haemaphysalis* sp.

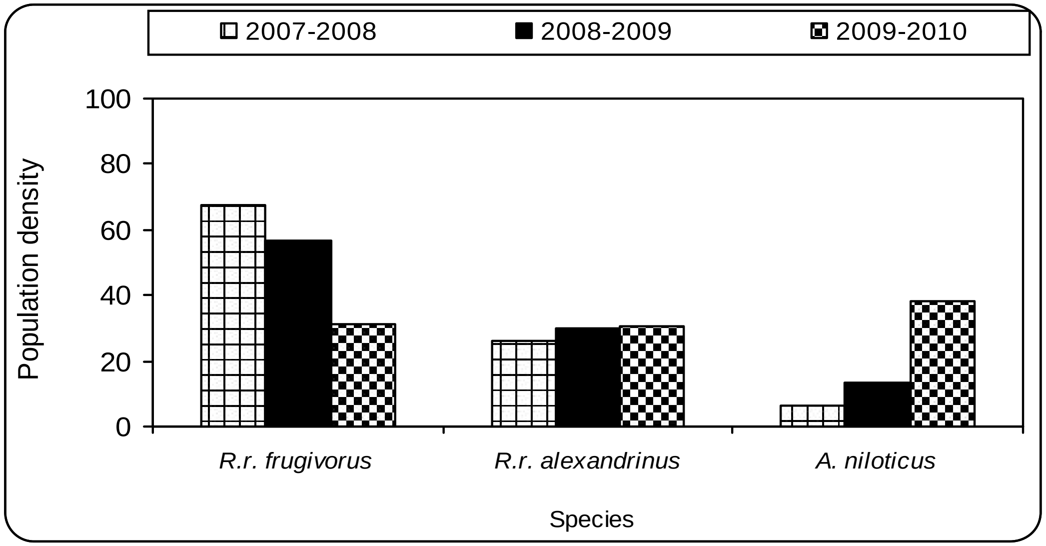


Fig. (1) Survey of rodent species in the farm animals of the Faculty of Agriculture, Assiut University during, 2007-2010.

3. Population density of ectoparasites:

3.1. Ectoparasites on animals:

The study showed that the population density of ectoparsites on animal's body surface (buffaloes, cattle and sheep). Data in Table (6) and the corresponding figures (2, 3, 4, 5 and 6) show the population density of animal ectoparasites in the animal production farm during 2008/2009. The results showed the presence of some dominant species of parasites on buffaloes, the lice represented 96.23% of the parasites population. The other were mites and ticks represented 3.77%. In cattle, mites and ticks represented 97.31% of the parasites population and the fleas represented only by 2.69%. In sheep, the fleas represented 78.47% of the parasites population and the mites and ticks represented 21.53%.

Table (6) also emphasized the monthly and seasonal abundance of some ectoparasites collected from the farm animals. The collected ectoparasites were: fleas, lice, mites and ticks. The captured fleas were the oriental rat flea, *Xenopsylla cheopis* and the human flea, *Pulex irritans*. The study of ectoparasites density showed that the highest density of ectoparasites in buffalo farm was observed in spring represented (50.66%) of the population, followed by summer season (39.92%) and autumn (6.03%). The lowest population was recorded during winter (3.39%), this may be due mainly to the presence of lice eggs on buffaloes hair during winter. In cattle, the highest density was observed in spring (66.37%) of the population followed by summer (26.46 %) and autumn (4.48%). The lowest population (2.69%) was recorded during winter season. In sheep-farm the highest density (67.83%) was observed in winter from the population studied followed by (20.88%) in spring and (6.10%) in autumn. The lowest population (5.19%) was recorded during summer. Buffalo were found to be harbored the highest density of ectoparasites in April and the lowest one was counted in November. In cattle, the highest density was recorded in May and the lowest was noticed in November and December.

In sheep, the highest density of ectoparasites was presented in January and the lowest one was in September. Data of the same Table showed that the highest population of fleas was noticed in sheep-farm during winter with 49.68%, followed by 17.51% in spring and the lowest one 5.19 % was observed during summer. Lice, mites and ticks showed different trend than fleas. The comparative study between farm-animals showed difference in the rate of infestation by ectoparasites.

In general, high populations of animal-ectoparasites were recorded as follow: buffaloes infested with lice, cattle infested with ticks and sheep infested with fleas.

Data in Table (7) and figures (4, 5 and 6) showed the percentage of each ectoparasite species in the animal production farm during 2009-2010.The results illustrated that some dominant species of parasites were found. On buffaloes, lic**e** represented 96.23%**,** while mites and ticks represented only 3.77%. No fleas were found on buffaloes. Mites and ticks represented 97.31% on cattle while fleas represented only by 2.69%. On sheep, fleas represented 78.47% while mites and ticks represented 21.53%. No lice were found on cattle or sheep. Several factors may be playing a role in the absence of some parasite species. The absence of fleas on buffaloes and the absence of lice on cattle and sheep may be due to the competition among different parasite species and/ or the thickness of the animal skin and/ or the thick hair of the animal **Omer *et al*. (2007).**

The collected ectoparasites as shown in Table (7) were found to be fleas, lice, mites and ticks. The captured fleas were the oriental rat flea, *Xenopsylla cheopis* and the human flea, *Pulex irritans*. The study of population density of ectoparasites showed that the highest density of ectoparasites in buffalo's farm was observed in spring 50.66% followed by summer

39.92% and autumn 6.03%. The lowest population was recorded during winter 3.39%. The highest population of ectoparasites on cattle was observed in spring 66.37% followed by summer 26.46 % and autumn 4.48%. The lowest population was recorded during winter 2.69%.

In sheep-farm, the highest population was observed in winter 67.83% followed by spring 20.88 % and autumn 6.10%. The lowest population was recorded during summer 5.19%. Buffalo ectoparasites were found to be harbored the highest density of ectoparasites in April and the lowest one in November while in cattle the highest density was recorded in May and the lowest ones were noticed in November and December. In sheep, the highest density of ectoparasites was in January and the lowest one in September.

Data from the same Table showed that the highest population of fleas was noticed in sheep farm during winter 49.68% followed by spring 17.51% and the lowest one was observed during summer 5.19 %. The study of other ectoparasites such as lice, mites and ticks did not show the same trend of fleas. The comparative study among farm animals showed that there was an increase in the rate of infestation by ectoparasites.

In general, high populations of animal ectoparasites were recorded as lice on buffaloes, ticks on cattle and fleas on sheep. This may be due **to increasing the activity of insects in spring**. **Temperature and** relative **humidity may be play an important role in the numerical density of external parasites. Similar results were obtained by Yakhchali and Hosseine (2006) and Kakar and Kakarsulemankhe**l **(2008).**

3.1.1. Effect of relative humidity and temperature on the population density of animal-ectoparasites.

The weather play factors a great role in population abundance of many species. Therefore, some physical factors, particularly mean **diurnal** temperature and relative humidity were investigated in the present study to declare the simultaneously effects on the population density of animal ectoparasites. Relationship between the population density of animal ectoparasites and the fluctuation of the weather factors was statistically tested using simple correlation analysis. The weather factors were maximum temperature (x_1), minimum temperature (x_2), maximum relative humidity(x_3), minimum relative humidity (x_4) mean diurnal temperature (x_5) and mean night temperature (x_6), which had been recorded over each inspected date.

Data in Table (8) show the correlation coefficients between the population of animal ectoparasites and the weather factors during 2008/2009. Data revealed that there is a significant positive correlation between the minimum temperature (0.48), the mean diurnal temperature (0.59) and the population of lice on buffaloes, in the same time the maximum and minimum relative humidity have a highly significant negative affect on the same population, - 0.80 and - 0.88, respectively. In contrary, the population of mites and ticks showed a highly negative significant correlation towards minimum temperature (- 0. 75) and mean diurnal temperature (- 0.77), and a significant positive effect with minimum (0.68) and maximum (0.62) relative humidity. In cattle, flea population negatively affected by minimum temperature and mean diurnal temperature but positively affected by maximum relative humidity and mean night temperature; correlation coefficient values of which were -0.63*, -0.61*, 0.48* and 0.59*, respectively. Mite and tick populations showed a significant positive correlation values with temperature group factors except mean diurnal temperature, and a significant negative relationship with relative humidity group factors. In sheep, population of fleas, mites and ticks significantly positive correlated (0.60*)

with minimum and (0.64^{*}) with maximum relative humidity, while highly significantly negative correlated with temperature group factors. Correlation coefficient values of maximum, minimum, mean diurnal and mean night temperatures were -0.72^{**}, -0.77^{**}, -0.75^{**} and -0.73^{**}, respectively. All correlation values were as similar as each other in all arthropod populations.

Data in Table (9) show relationship between the population of each lice, fleas, mites and ticks; and temperature factor groups (minimum, maximum, mean diurnal and mean night temperatures) and relative humidity factor groups (minimum and maximum R.H) on buffaloes, cattle and sheep during 2009-2010. Results of lice on buffaloes show highly significant negative correlations (-0.75^{**} and -0.78^{**}) with both relative humidity factors, respectively. Temperature factor groups were none significant except mean diurnal temperature, which was significant with a value 0.48^{*}. Meanwhile the mites and ticks were in contrary comparing to lice. Results show highly significant negative correlations regarding to temperature factor groups, where the values of which, as mentioned above, were -0.90^{**}, -0.85^{**}, -0.88^{**} and -0.83^{**} but the relationships with relative humidity had highly significant positive values, 0.77^{**} and 0.78^{**}, respectively. The population of fleas on cattle gave a significant negative correlation coefficient, which ranged between -0.56 - -0.68, whereas the one factor, maximum of relative humidity group was positively significant (0.57^{*}). The population of mites and ticks none significantly correlated with the temperature factor groups and negatively significant correlated with both of relative humidity factor groups; correlation coefficient values were -0.69^{*} and -0.71^{**}, respectively, as aforementioned. The correlation coefficients of flea, mite and tick populations have the same trend where highly negative significant with the temperature factors group and ranged from -0.76 to -0.89, whilst the relative humidity factor groups significantly positive correlated with the population of these arthropods, and varied from 0.65 to 0.70.

Table (6) Seasonal and monthly abundance of some ectoparasites collected from farm animals of the Faculty of Agriculture, Assiut University during, 2008-2009.

Species / Months	**Buffalo parasites (%)**				**Cattle parasites (%)**				**Sheep parasites (%)**			
	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total
Dec.	0	0	1.51	1.51	0	0	0	0	0	22.96	7.13	30.09
Jan.	0	0	1.13	1.13	0	1.35	0	1.35	0	15.82	6.10	21.92
Feb.	0	0	0.75	0.75	0	1.35	0	1.35	0	10.89	4.93	15.82
Winter	**0**	**0**	**3.39**	**3.39**	**0**	**2.69**	**0**	**2.69**	**0**	**49.68**	**18.16**	**67.83**
March	5.65	0	0.38	6.03	0	0	14.80	14.80	0	7.91	1.82	9.73
April	23.92	0	0	23.92	0	0	22.87	22.87	0	5.71	1.30	7
May	20.72	0	0	20.72	0	0	28.70	28.70	0	3.89	0.26	4.15
Spring	**50.28**	**0**	**0.38**	**50.66**	**0**	**0**	**66.37**	**66.37**	**0**	**17.51**	**3.37**	**20.88**
June	17.14	0	0	17.14	0	0	12.56	12.56	0	2.20	0	2.20
July	14.50	0	0	14.50	0	0	9.42	9.42	0	1.56	0	1.56
Aug.	8.29	0	0	8.29	0	0	4.48	4.48	0	1.43	0	1.43
Summer	**39.92**	**0**	**0**	**39.92**	**0**	**0**	**26.46**	**26.46**	**0**	**5.19**	**0**	**5.19**
Sept.	3.95	0	0	3.95	0	0	3.14	3.14	0	1.30	0	1.30
Oct.	1.51	0	0	1.51	0	0	1.35	1.35	0	1.95	0	1.95
Nov.	0.56	0	0	0.56	0	0	0	0	0	2.85	0	2.85
Autumn	**6.03**	**0**	**0**	**6.03**	**0**	**0**	**4.48**	**4.48**	**0**	**6.10**	**0**	**6.10**
Total	96.23	0	3.77	100	0	2.69	97.31	100	0	78.47	21.53	100

Table (7) Seasonal and monthly abundance of some ectoparasites collected from farm animals of the Faculty of Agriculture, Assiut University during, 2009 - 2010.

Species / Months	Buffalo parasites (%)				Cattle parasites (%)				Sheep parasites (%)			
	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total
Dec.	0.08	0	1.62	1.70	0	0.74	0	0.74	0	21.65	1.31	22.96
Jan.	0.16	0	0.89	105	0	1.73	0	1.73	0	26.80	1.94	28.74
Feb.	0.73	0	0.65	1.37	0	2.72	0	2.72	0	22.75	2.10	24.86
Winter	**0.97**	**0**	**3.15**	**4.12**	**0**	**5.19**	**0**	**5.19**	**0**	**71.20**	**5.36**	**76.56**
March	4.45	0	0.49	4.93	0	0	11.60	11.60	0	7.99	0.21	8.20
April	23.20	0	0	23.20	0	0	21.73	21.73	0	6.46	0.11	6.57
May	29.99	0	0	29.99	0	0	27.65	27.65	0	3.73	0	3.73
Spring	**57.64**	**0**	**0.49**	**58.12**	**0**	**0**	**60.99**	**60.99**	**0**	**18.18**	**0.32**	**18.50**
June	13.42	0	0	13.42	0	0	8.89	8.89	0	1.16	0	1.16
July	12.37	0	0	12.37	0	0	14.07	14.07	0	0.53	0	0.53
Aug.	5.98	0	0	5.98	0	0	4.20	4.20	0	0	0	0
Summer	**31.77**	**0**	**0**	**31.77**	**0**	**0**	**27.16**	**27.16**	**0**	**1.68**	**0**	**1.68**
Sept.	3.64	0	0	3.64	0	0	3.21	3.21	0	0.63	0	0.63
Oct.	1.29	0	0	1.29	0	0	2.47	2.47	0	0.74	0	0.74
Nov.	0.49	0	0.57	1.05	0	0	0.99	0.99	0	1.89	0	1.89
Autumn	**5.42**	**0**	**0.57**	**5.98**	**0**	**0**	**6.67**	**6.67**	**0**	**3.26**	**0**	**3.26**
Total	95.80	0	4.20	100	0	5.19	94.81	100	0	94.32	5.68	100

Table (8) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from farm animals of the Faculty of Agriculture, Assiut University during , 2008-2009.

Species weather factors	**Buffalo** parasites				**Cattle** parasites				**Sheep** parasites			
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total
X1	0.53	0	-0.73**	0.50	0	-0.56	0.36*	0.34*	0	-0.72**	-0.74**	-0.73**
X2	0.48*	0	-0.75**	0.45*	0	-0.63*	0.26*	0.23*	0	-0.77**	-0.80**	-0.78**
X3	-0.80**	0	0.62*	-0.79**	0	0.48*	-0.61*	-0.60*	0	0.60*	0.63*	0.61*
X4	-0.88**	0	0.68*	1.87**	0	0.43	-0.76**	-0.75**	0	0.64*	0.66*	0.65*
X5	0.59*	0	-0.77**	0.56n	0	-0.61*	0.40	0.38*	0	-0.75**	-0.79**	-0.77**
X6	0.57-	0	-0.73**	0.55n	0	0.59*	0.38*	0.36	0	-0.73**	-0.76**	-0.75**

Table (9) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from farm animals of the Faculty of Agriculture, Assiut University during 2009-2010.

Species weather f.	**Buffalo** parasites				**Cattle** parasites				**Sheep** parasites			
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Tick s	Total
X1	0.50	0	-0.90**	0.47	0	-0.67*	0.43	0.39	0	-0.89**	-0.80**	-0.89**
X2	0.43	0	-0.85**	0.39	0	-0.68*	0.37	0.32	0	-0.89**	-0.81**	-0.89**
X3	-0.78**	0	0.78**	0.76**	0	0.57*	-0.71**	-0.69*	0	0.70*	0.69*	0.70*
X4	-0.75**	0	0.77**	-0.73**	0	0.51	-0.69*	-0.67*	0	0.65*	0.63*	0.67*
X5	0.48*	0	-0.88**	0.45	0	-0.67*	0.42	0.37	0	-0.88**	-0.80**	-0.88**
X6	0.40	0	-0.83**	0.37	0	-0.56*	0.33	0.28	0	-0.76**	-0.68*	-0.76**

X1= max temperature X2= min temperature X3= max relative humidity X4= min relative humidity X5= mean diurnal temperature
X6= mean night temperature * significant ** highly significant

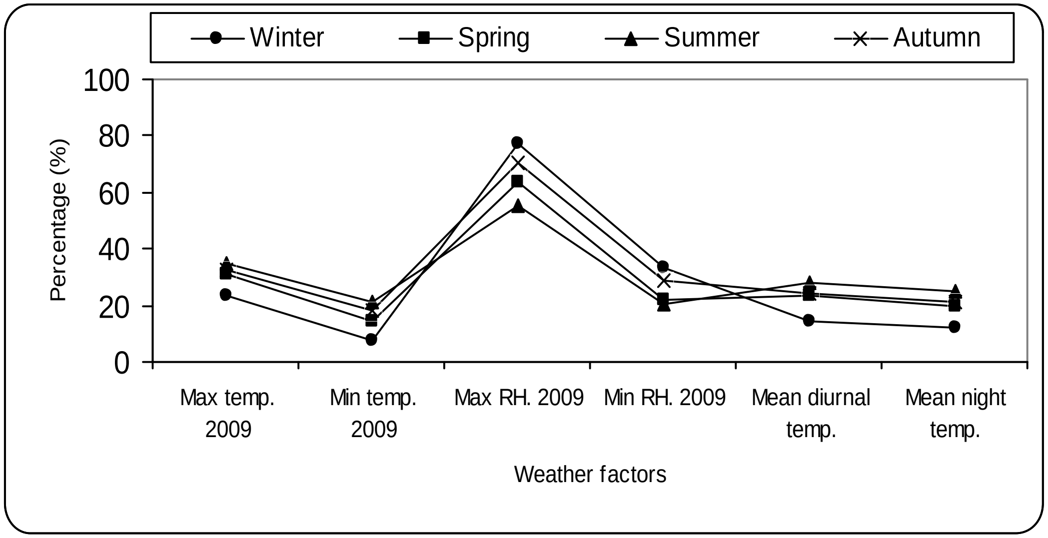


Fig. (2) Meteorological data collected from station in Assiut University during, 2008-2009.

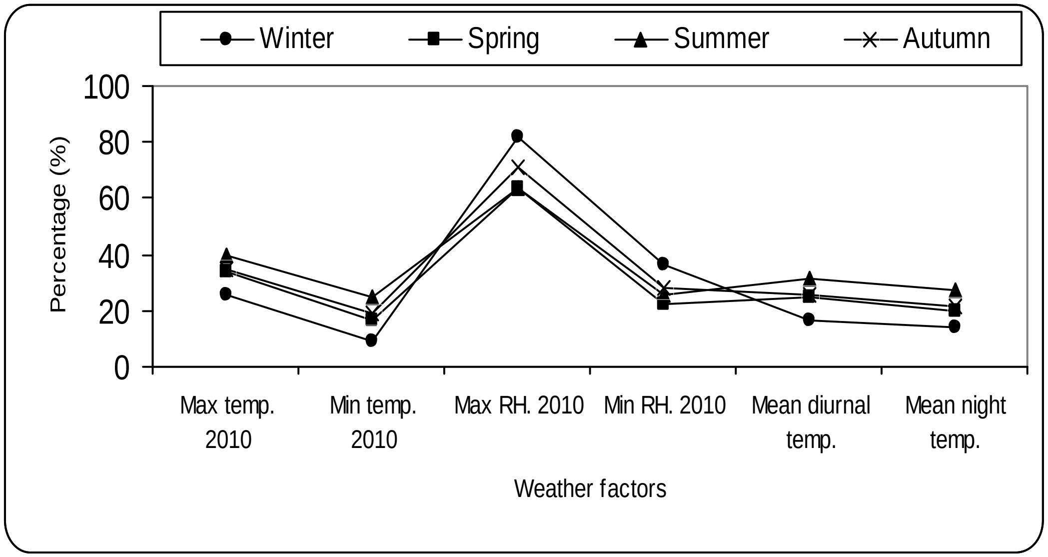


Fig. (3) Meteorological data collected from station in Assiut University during, 2009-2010.

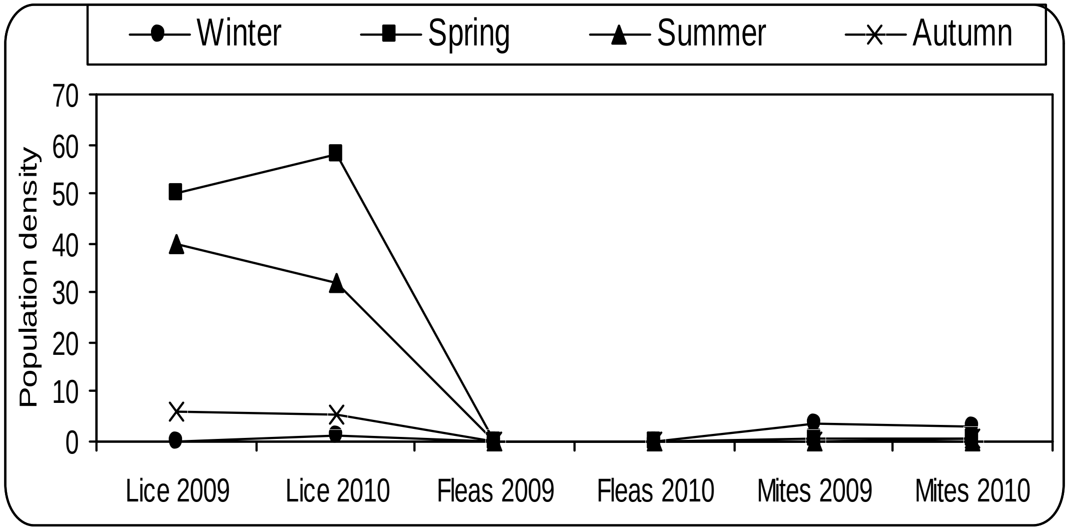


Fig.(4) Seasonal abundance of some ectoparasites collected from buffalo body surface, in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

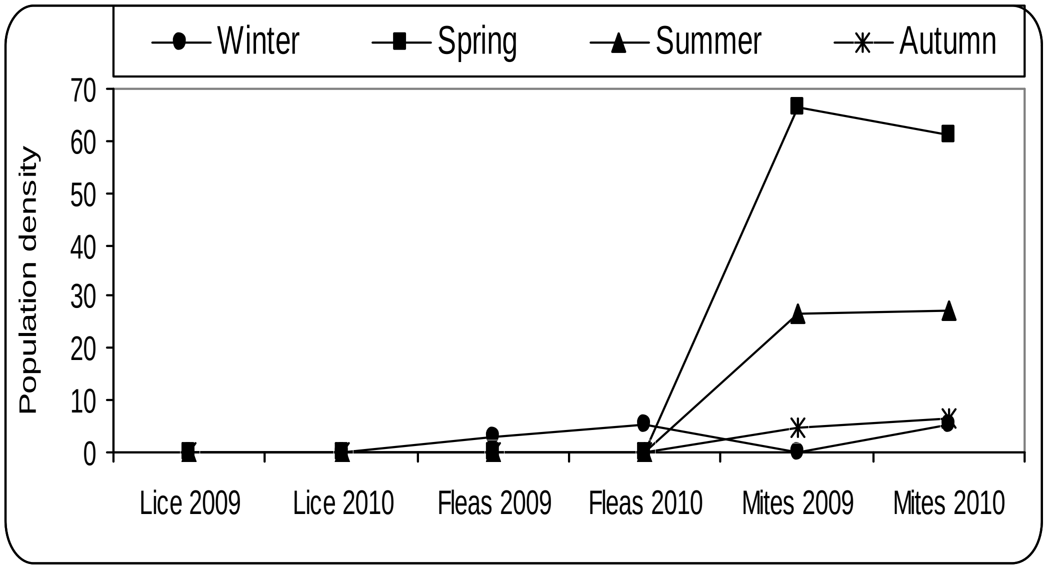


Fig. (5) Seasonal abundance of some ectoparasites collected from cattle body surface, in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

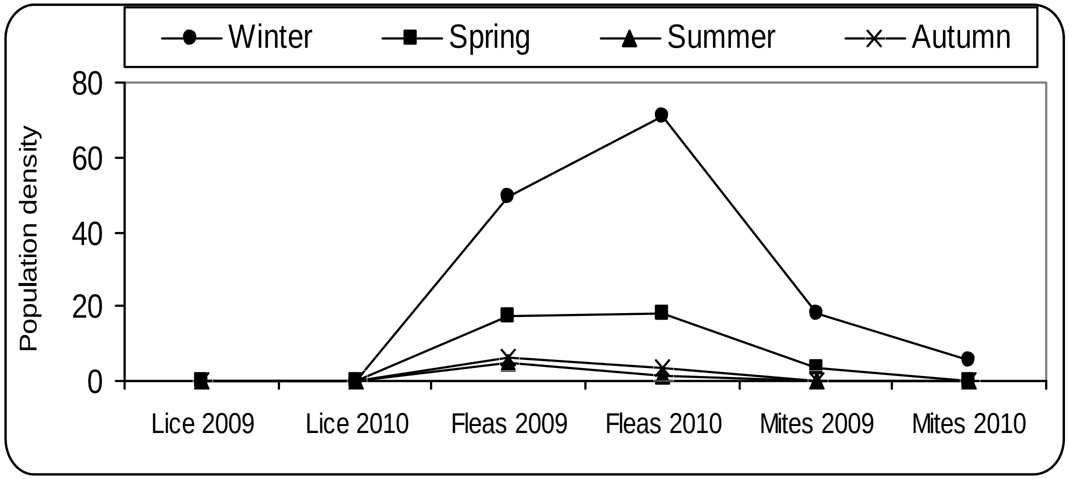


Fig.(6) Seasonal abundance of some ectoparasites collected from sheep body surface, in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

3.2. Ectoparasites collected from animal manure:

Data in Table (10) and figures (7, 8 and 9) showed the population of ectoparasite species in the animal soil of farm animal during 2008/2009. In cattle-sheds, mites and ticks were represented by 61.54% of the parasites population, while fleas were represented by 38.46%, none of lice species were extracted. In sheep-sheds, the fleas were represented by

98.44% of the parasites population while, mites and ticks were represented only by 0.83%. This may be due to hatching of flea eggs in the soil of animal-sheds.

The same Table (10) emphasized the seasonal abundance of some ectoparasites collected from animals sheds. The collected ectoparasite species were: fleas, lice, mites and ticks. The study of ectoparasites density showed that the highest density of ectoparasites in cattle-farm was observed in spring 42.31% from the population followed by winter 41.03% and summer 16.67%. In autumn the ectoparasites were absent from animal-sheds. In sheep-sheds the ectoparasites were counted in winter 74.98% from the population followed by spring 17.25 % and autumn 4.23%. The lowest population was recorded during summer 3.54%.

The ectoparasites collected from soils of rodent burrows in animal production farm, revealed that, the highest population density was observed during spring 35.60% from the population followed by winter 30.55% and autumn 20.22%. The lowest population13.63% was recorded during summer. Cattle-sheds were found to be harbored the highest density of ectoparasites in January 24.36% and absence in September, October and November, while in sheep-sheds the highest density 26.82% was recorded in January and the lowest ones were noticed in August. In rodent burrows the highest density of ectoparasites was found in January 22.86% and absence in December.

Data in Table (11) and figures (7, 8 and 9) show the population of ectoparasite species in the animal soil production farm during 2009/2010. The dominant species of parasites, in cattle-sheds were: mites and ticks that represented by 70.27% of the parasite population and the second species was the fleas that represented by 29.73%. This may be **due to the presence** of tick **females inside the ground for laying eggs. Therefore, large numbers of larvae and nymphs were** extracted from manure of animals, while in sheep-sheds, the fleas represented by 98.11% of the parasites population, while, mites and ticks were represented by1.89 %, this may be due to the dependence of fleas on sheep.

Table (11) also emphasized an average seasonal abundance of some ectoparasites collected from animals-sheds, certain species such as fleas, lice, mites and ticks were collected. The study of ectoparasites density showed that the highest density35.14% of ectoparasites in cattle soils was observed in autumn from the population studied followed by30.63% in spring and 19.82% in summer. The lowest density 14.41% was recorded during winter. In sheep sheds the highest density 64.79% was observed in winter followed by 21.73% in spring and 7% in autumn. The lowest population was recorded during summer 6.48%.

In the soil collected from rodent burrows in animal production farm, the highest population was observed in autumn 35.45% from the population followed by 24.75 % in spring and winter 22.41%. The lowest population was recorded during summer17.39%. Cattle-shed, ectoparasites were found to be harboured the highest density of ectoparasites in May 17.12% and the lowest one in December with absence of ectoparasites while in sheep-sheds the highest density was recorded in December 24.08% and the lowest one was noticed in October 1.09. In rodent burrows, the highest density of ectoparasites was recorded in March 15.38% and the lowest one in August 3.34%. This data were in accordance with the data obtained by **Kolar *et al*.(2008)**.

3.2.1. Effect of relative humidity and temperature on the population density of animals manure ectoparasites:

Data in Table (12) show the correlation coefficients between the population density of animal soil ectoparasites versus the weather factors during 2008/2009. Data revealed that there is a significant negative correlation between the minimum temperature (0.-0.63), the mean diurnal temperature (-0.61), the mean night temperature (-0.86) and the population density of fleas in cattle-sheds, in the same time, the population of mites and ticks showed insignificant correlation towards weather factors. In sheep-sheds, fleas population negatively affected by maximum, minimum temperature, mean diurnal temperature and mean night temperature but positively affected by maximum relative humidity and minimum humidity; correlation coefficient values of were -0.79**, -0.85**,-0.84**, -0.81**, 0.65* and 0.65*, respectively. Mite and tick populations negatively affected by maximum, minimum temperature, mean diurnal temperature and mean night temperature but positively affected by maximum relative humidity and minimum humidity; correlation coefficient values of which were -0.60*, -0.70*,-0.68*, -0.72**, 0.64* and 0.62*, respectively. In rodent burrows, fleas population negatively affected by maximum relative humidity and minimum humidity; correlation coefficient values of which were -0.68*, -0.62* respectively. Mite and tick populations did not affect by weather factors.

Data in Table (13) show relationships between the population of lice, fleas, mites and ticks, and temperature factor groups (minimum, maximum, mean diurnal and mean night temperatures) and relative humidity factor groups (minimum and maximum R.H) on animals soil during 2009-2010. Results of fleas in cattle sheds show significant positive correlations with maximum relative humidity, mites and ticks population positively affected by maximum , minimum temperature , mean diurnal temperature and mean night temperature but negatively affected by maximum relative humidity and minimum humidity; correlation coefficient values of which were 0.72**, 0.63*,0.701*, 0.60*, -0.87** and -0.92**, respectively. In sheep sheds, fleas population negatively affected by maximum , minimum temperature , mean diurnal temperature and mean night temperature but positively affected by maximum relative humidity and minimum humidity; correlation coefficient values of which were -0.93**, -0.92**,-0.92**,-0.84**, 0.75**, 0.72** respectively. Mite and tick populations showed negatively affected by maximum, minimum temperature , mean diurnal temperature and mean night temperature but positively affected by maximum relative humidity and minimum humidity; correlation coefficient values of which were -0.94*[*], -0.92*[*],-0.92**,-0.83**, 0.75**, 0.72*[*] respectively. In rodent burrows, the population did not show changes to weather factors.Generally, Temperature play an important role in the intensity of external parasites in the soil and rotate him or clean through the mites exist in abundance in winter, also developed stages for the Acari and the process of activity for fleas. **Bazarusanga *et al*. (2007).**

Table (10) Seasonal and monthly abundance of some ectoparasites collected from soil in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2009.

Species	**Cattle manure parasites (%)**				**Sheep manure parasites (%)**				**Rodent burrow parasites (%)**			
Months	Lice	Fleas	Mites + Ticks	Total	Lice	Fleas	Mites + Ticks	Total	Lice	Fleas	Mites + Ticks	Total
Dec.	0	2.56	0	2.56	0	23.32	0.09	23.41	0	0	0	0
Jan.	0	19.23	5.13	24.36	0	26.68	0.14	26.82	0	0	7.69	7.69
Feb.	0	11.54	2.56	14.10	0	24.52	0.23	24.75	1.10	0.44	21.32	22.86
Winter	**0**	**33.33**	**7.69**	**41.03**	**0**	**74.52**	**0.46**	**74.98**	**1.10**	**0.44**	**29.01**	**30.55**
March	0	-	10.26	10.26	0.14	9.89	0.05	10.07	0.88	0.22	10.55	11.65
April	0	1.28	19.23	20.51	0.18	2.53	0.05	2.76	0.66	0.44	16.92	18.02
May	0	3.85	7.69	11.54	0.28	4.09	0.05	4.42	0	0.44	5.49	5.93
Spring	**0**	**5.13**	**37.18**	**42.31**	**0.60**	**16.51**	**0.14**	**17.25**	**1.54**	**1.10**	**32.97**	**35.60**
June	0	0	8.97	8.97	0	2.21	0	2.21	0.44	0.66	2.64	3.74
July	0	0	2.56	2.56	0	1.01	0	1.01	0	1.10	3.30	4.40
Aug.	0	0	5.13	5.13	0.09	0.23	0	0.32	0.22	0.88	4.40	5.49
Summer	**0**	**0**	**16.67**	**16.67**	**0.09**	**3.45**	**0**	**3.54**	**0.66**	**2.64**	**10.33**	**13.63**
Sept.	0	0	0	0	0.05	0	0	0.05	0	0.22	5.93	6.15
Oct.	0	0	0	0	0	0.55	0.14	0.69	0	0	12.09	12.09
Nov.	0	0	0	0	0	3.40	0.09	3.50	0	0.22	1.76	1.98
Autumn	**0**	**0**	**0**	**0**	**0.05**	**3.96**	**0.23**	**4.23**	**0**	**0.44**	**19.78**	**20.22**
Total	0	38.46	61.54	100	0.74	98.44	0.83	100	3.30	4.62	92.09	100

Table (11) Seasonal and monthly abundance of some ectoparasites collected from soil in farm animals of the Faculty of Agriculture, Assiut University during, 2009 - 2010.

Species / Months	Cattle manure parasites (%)				Sheep manure parasites (%)				Rodent burrow parasites (%)			
	Lice	Fleas	Mites + Ticks	Total	Lice	Fleas	Mites + Ticks	Total	Lice	Fleas	Mites + Ticks	Total
Dec.	0	0	0	0	0	23.51	0.57	24.08	0	1.00	9.36	10.37
Jan.	0	7.21	0	7.21	0	21.62	0.46	22.08	0.33	0.67	5.69	6.69
Feb.	0	5.41	1.80	7.21	0	18.29	0.34	18.64	1.00	0.33	4.01	5.35
Winter	**0**	**12.61**	**1.80**	**14.41**	**0**	**63.42**	**1.38**	**64.79**	**1.34**	**2.01**	**19.06**	**22.41**
March	0	1.80	3.60	5.41	0	11.64	0.17	11.81	0.67	0.33	14.38	15.38
April	0	0.90	7.21	8.11	0	5.85	0.11	5.96	0.33	0	5.35	5.69
May	0	1.80	15.32	17.12	0	3.90	0.06	3.96	0.33	0.33	3.01	3.68
Spring	**0**	**4.50**	**26.13**	**30.63**	**0**	**21.39**	**0.34**	**21.73**	**1.34**	**0.67**	**22.74**	**24.75**
June	0	0	10.81	10.81	0	1.95	0	1.95	0	0.67	7.02	7.69
July	0	0	2.70	2.70	0	2.35	0	2.35	0	0.33	6.02	6.35
Aug.	0	0	6.31	6.31	0	2.18	0	2.18	0	1.34	2.01	3.34
Summer	**0**	**0**	**19.82**	**19.82**	**0**	**6.48**	**0**	**6.48**	**0**	**2.34**	**15.05**	**17.39**
Sept.	0	0	9.01	9.01	0	0.86	0	0.86	0	0	11.37	11.37
Oct.	0	3.60	11.71	15.32	0	1.03	0.06	1.09	1.00	0.33	13.04	14.38
Nov.	0	9.01	1.80	10.81	0	4.93	0.11	5.05	0	1.00	8.70	9.70
Autumn	**0**	**12.61**	**22.52**	**35.14**	**0**	**6.82**	**0.17**	**7**	**1.00**	**1.34**	**33.11**	**35.45**
Total	0	29.73	70.27	100	0	98.11	1.89	100	3.68	6.35	89.97	100

Table (12) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from animals soils of the Faculty of Agriculture, Assiut University during, 2008-2009.

Species / weather factors	**Cattle manure parasites**				**Sheep manure parasites**				**Rodent burrows parasites**			
	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total	Lice	Fleas	Mites+ Ticks	Total
X1	0	-0.57	0.19	-0.29	0.30	-0.79**	-0.60*	-0.79**	-0.17	0.35	-0.15	-0.14
X2	0	-0.63*	0.04	-0.45	0.16	-0.85**	-0.70*	-0.85**	-0.34	0.47	-0.32	-0.30
X3	0	0.45	-0.29	0.13	-0.29	0.65*	0.64*	0.65*	0.17	-0.68*	0.22	0.19
X4	0	0.40	90.55	-0.09	-0.45	0.65*	0.62*	0.65*	-0.08	-0.62*	0.01	-0.02
X5	0	-0.61*	0.22	-0.30	0.30	-0.84**	-0.68*	-0.84**	-0.21	0.44	-0.20	-0.18
X6	0	-0.86*	0.17	-0.32	0.27	-0.81**	-0.72**	-0.81**	-0.23	0.49	-0.26	-0.23

Table (13) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from animals soils of the Faculty of Agriculture, Assiut University during, 2009-2010.

Species weather factors	**Cattle manure parasites**				**Sheep manure parasites**				**Rodent burrows parasites**			
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total
X1	0	-0.55	0.72**	-0.39	0	-0.93**	-0.94**	-0.93**	-0.28	-0.15	-0.16	-0.21
X2	0	-0.55	0.63*	0.30	0	-0.92**	-0.92**	-0.92**	-0.34	-0.8	-0.13	-0.17
X3	0	0.56*	-0.87**	-0.54	0	0.75**	0.75**	0.75**	0.09	0.38	0.15	0.19
X4	0	0.49	-0.92**	-0.64*	0	0.72**	0.72**	0.72**	-0.74	0.44	0.09	0.13
X5	0	-0.56	0.70*	0.36	0	-0.92**	-0.93**	-0.92**	-0.31	-0.13	-0.15	-0.19
X6	0	-0.46	0.60*	0.32	0	-0.83**	-0.84**	-0.83**	-0.37	-0.06	-0.20	-0.45

X1= max temperature X2= min temperature X3= max relative humidity X4= min relative humidity
X5= mean diurnal temperature X6= mean night temperature * significant ** highly significant

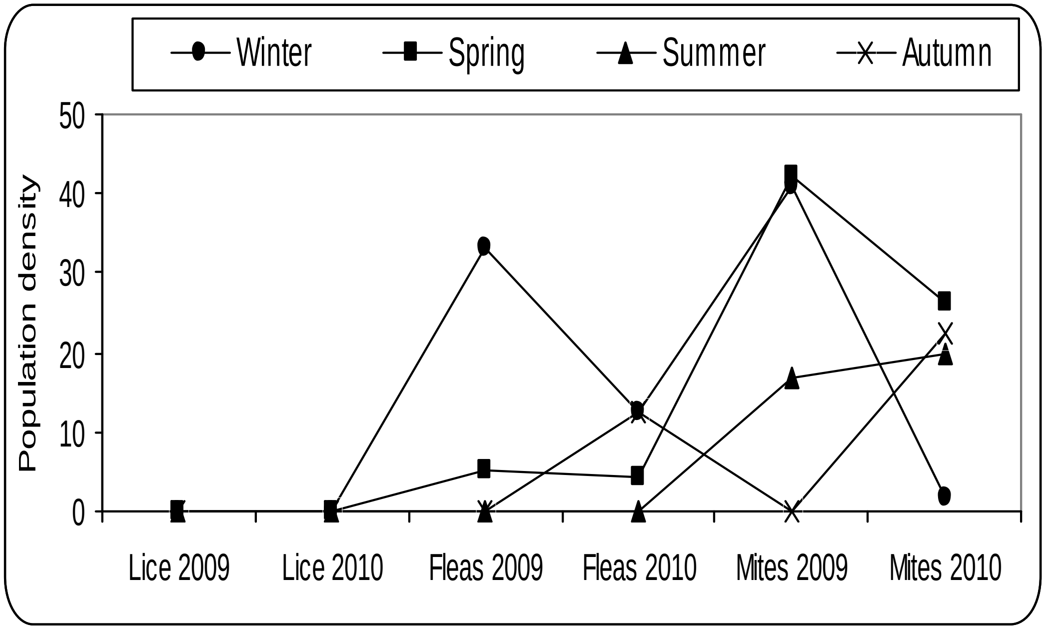


Fig. (7) Seasonal abundance of some ectoparasites collected from cattle sheds, in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

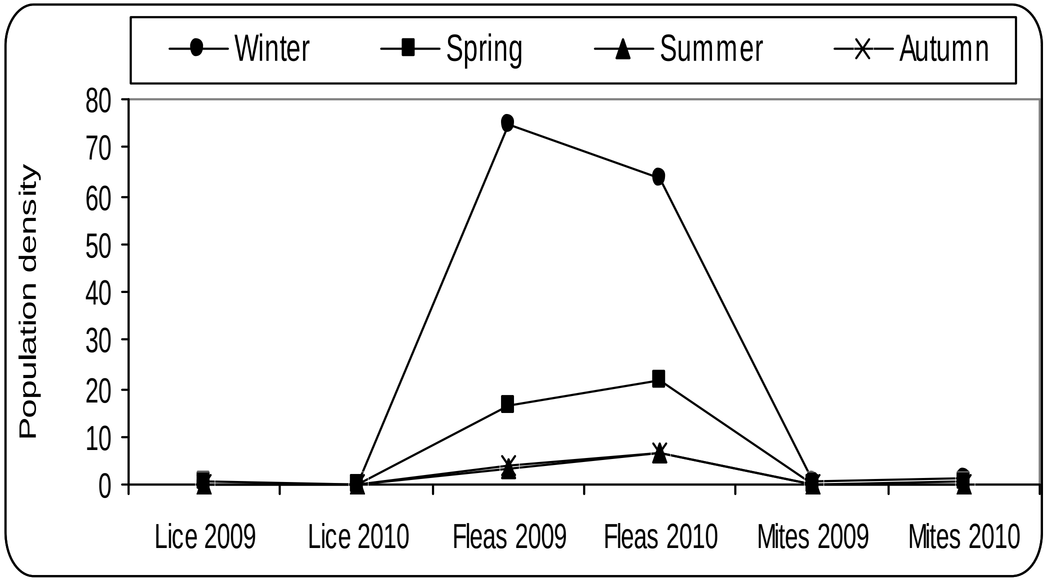


Fig.(8) Seasonal abundance of some ectoparasites collected from sheep sheds in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

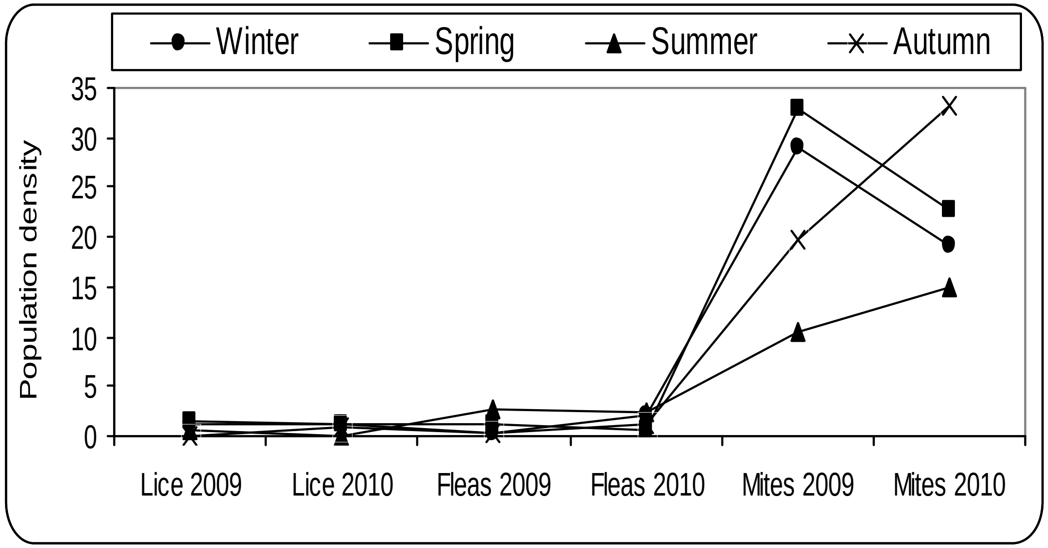


Fig. (9) Seasonal abundance of some ectoparasites collected from rodent burrows in farm animals of the Faculty of Agriculture, Assiut University during, 2008-2010.

3.3. Ectoparasites on Rodents:

3.3.1. Ectoparasites collected from *Rattus r. frugivorus* body surface:

Data in Table (14) and figures (10 and11) emphasized the average seasonal abundance of some ectoparasites collected from the body surface of white bellied rat, *R. r. frugivorus*, during 2007-2009. The collected ectoparasites were: fleas, lice, mites and ticks. The captured fleas were the oriental rat flea, *Xenopsylla cheopis* and the human flea, *Pulex irritans*. The study of rodent ectoparasites density showed that the highest density of ectoparasites on *R. r. frugivorus* was observed in autumn 34.08% followed by spring 27.99% and summer 22.31%. The lowest population was recorded during winter 15.62%.

Male of rodents were found to be harbored the highest density of ectoparasites during March and the lowest one was in January. In female rodents, the highest density was recorded in October and the lowest was noticed in January. Data from the same Table showed that the highest population of fleas was noticed during autumn 34.08% followed by spring 27.99%.The lowest density was observed during winter 12.50%. The study of other ectoparasites (i.e., lice, mites and ticks) showed the same trend of infestation. The comparative study between males and females showed that there was an increase in the rate of infestation by females than males.

Data in Table (15) emphasized an average seasonal abundance of some ectoparasites collected from the white bellied rat, *Rattus r. frugivorus*, during 2009- 2010. Male rodents were found to be harbored the highest density of ectoparasites in February and the lowest density in August, while in female rodents, the highest density was recorded in October and the lowest one was noticed in June. Data from the same Table showed that the highest population of fleas was noticed during autumn 34.99% followed by spring 30.20%.The lowest density was observed during summer 11.90%. The study of other ectoparasites (lice, mites and tick) did not show the same trend of fleas. The comparative study between males and females showed that there was an increase in the rate of infestation by females than males. This may be due to the large body surface and the slow movement of females as compared with males. The results of this study were similar to the results obtained by **Embarak (1997) and Zahedi *et al*. (1996**).

3.3.1.1. Effect of relative humidity and temperature on the abundance of ectoparasites extracted from *R. r. frugivorus* body surface:

Data in Table (16) show the correlation coefficients between the population of animal ectoparasites and the weather factors during 2007/2009. Data revealed that there is a significant negative correlation between the minimum relative humidity (-0.45*), the minimum relative humidity (-0.65**) and the population of fleas on males, in the same time the maximum and minimum relative humidity have a significant positive affect on mites on males, 0.43* and 0.59**, respectively.

In females, lice population positively affected by maximum temperature, minimum temperature and the mean diurnal temperature, 0.24*, 0.22*, 0.24*. Fleas population negatively affected by maximum , minimum relative humidity but positively affected by the maximum, minimum, mean diurnal temperature and mean night temperature; correlation coefficient values of which were: -0.0.63**, -0.80*,0.32*, -0.28**, 0.38* and .0.40*, respectively. In females, mites population positively affected by maximum temperature, maximum relative humidity, minimum relative humidity, 0.34*, 0.46*, 0.42*.

Data in Table (17) show relationships between the population of lice, fleas, mites and ticks and temperature factor groups (minimum, maximum, mean diurnal and mean night temperatures) and relative humidity factor groups (minimum and maximum R.H) on rodents during 2009-2010. Results of lice on males show significant negative correlations with both relative humidity factors, -0.31* and -0.0.45*, respectively. Fleas population negatively affected by maximum, minimum temperature, mean diurnal temperature and mean night temperature; correlation coefficient values of which were: -.0.0.45*, -.0.55*,-0.55**, -0.63**, respectively. Mites population negatively affected by the maximum, minimum , mean diurnal temperature and mean night temperature but positively affected by maximum and minimum relative humidity, correlation coefficient values of which were: -0.0.62*[*], -0.62*[*],0.65**, -0.80**, 0.42[*] and .0.31[*], respectively.

3.3.2. Ectoparasites collected from *Rattus r. alexandrines* body surface:

Data in Table (18) and figures (12 and 13) show the ectoparasite species on the body surface of the grey bellied rat, *R. r. alexandrines* during 2007-2009. In this Table the highest density of ectoparasites was recorded during spring season followed by summer and autumn representing 40.96%, 27.39% and 22.07%, respectively. The lowest density was observed during winter 9.58%. Male rodents were harbored the highest density of ectoparasites in June, while the lowest density was in September. In female rodents the highest density was found in both rodent species *R.r.frugivorus* and *R.r.alexandrinus* in April and the lowest density was in January. The study of all collected ectoparasites showed that the highest density of fleas was observed during winter in males 4.05 % and during summer in females, 12.32%. The lowest density was observed during winter and autumn 1.97% in males and in spring 1.97%in females Table (18). On the other hand, the density of lice species showed that moderate population was observed during spring in males 13.87%. In females, the density was 12.32% in spring.

In general, high population of rodent ectoparasites was recorded in white bellied rat than in grey rat. This finding may be due mainly to the high numbers of the former than the latter in addition to increasing weight and size of *R.r.frugivorus*. The results were in agreement with the results obtained by **Maher Ali *et al.* (1974) and Ahmed (2006)**.

Data in Table (19) show the ectoparasite species on the body surface of the grey bellied rat, *Rattus r. alexandrinus* during 2009-2010. In this Table, the highest density of ectoparasites was recorded during spring season 45.63% followed by winter and summer representing 8.13% and 10.63% respectively. The lowest density was observed during winter representing 8.13%. Male rodents were harbored the highest density of ectoparasites in April and October, and the lowest one in January. In female rodents, the highest density was found in both rodent species in November and the lowest was in September. The study of all collected ectoparasites showed that the highest density of fleas was observed during spring in males 11.51% and11.05% in females. No parasites were observed in winter on females and in autumn in males. The density was only 1.10% in winter on females (Table 19). On the other hand, the density of lice species showed that moderate population was observed during spring in males and females representing 16.55% and 13.81% in spring, respectively.

In general, high population of rodent ectoparasites was recorded in white bellied rat than in grey bellied rat. This may be due to high number of the former than the latter species and the increasing weight and size of *R.r.frugivorus*. These results were in agreement with the results obtained by **Omudu and Ati (2010).**

3.3.2.1. Effect of relative humidity and temperature on the abundance of ectoparasites extracted from *R. r. alexandrines* body surface:

Data in Table (20) show the correlation coefficients between the population of *Rattus rattus alexandrinus* and the weather factors during 2007/2009. Data revealed that there is a significant positive correlation between the maximum temperature (0.28*), the mean diurnal temperature (0.30*), the mean night temperature (0.21*) and the population of lice on males, in the same time, the maximum and minimum relative humidity have a significant negative affect on lice, -0.38* and -0.48*, respectively. Fleas population negatively affected by maximum, minimum relative humidity; correlation coefficient values of which were: -.0.30*, -00.19*, respectively. In females, lice population positive affected by maximum temperature, minimum relative humidity, the mean diurnal temperature, and the mean night temperature; correlation values were: 0.24*, 0.61**, 0.26*, and 0.22*, respectively, nevertheless, negatively affected by minimum relative humidity, correlation coefficient values of which were -0.44* respectively. Fleas population positively affected by minimum temperature, 0.24* but negatively affected by maximum and minimum relative humidity, correlation coefficient values of which were: -0.57*, -0.43* respectively, mites population did not shows significant relation with weather factors.

Data in Table (21) show the correlation coefficients between the population of *Rattus r. alexandrinus* and the weather factors during 2007/2009. Data revealed that there is a significant positive correlation between the maximum temperature (0.25*), and the population of lice on males, in the same time the minimum relative humidity have a significant negative affect on lice, -0.24*. Fleas population negatively affected by maximum, minimum relative humidity but positively affected by, the maximum, minimum, mean diurnal temperature and mean night temperatures; correlation coefficient values of which were: -0.0.66**, -0.67*,0.48*, -0.39**, 0.45* and .0.38*, respectively, mites population negatively affected by maximum , minimum relative humidity but positively affected by, the maximum, temperature; correlation coefficient values of which were: -0.0.30*, -0.42*,0.0.24*, respectively

In females, lice population negatively affected by the mean night temperature, -0.20*. Fleas population negatively affected by maximum and minimum relative humidity, correlation coefficient values of which were: -0.26*, -0.35* respectively, mites population negatively affected by maximum and minimum relative humidity, correlation coefficient values of which were: -0.33*, -0.42*, respectively.

3.3.3. Ectoparasites collected from *Arvicanthis niloticus* body surface:

Data in Table (22) and figure (14) show the ectoparasite species on the body surface of the Nile grass rat, *A. niloticus* during 2009-2010. From this Table high density of ectoparasites was recorded during summer and spring with 31.37%, 29.81%, respectively. The lowest density was observed during winter, 11.49%. Male rodents were found to be harbored the highest density of ectoparasites in April, November and the lowest one in February, while in female rodents, the highest density was found in both rodent species in June, July and the lowest one in January. The study of all collected ectoparasites showed that the highest density of fleas was observed during winter in the case of males, 7.35% and during spring and autumn in females with 5.91% and the lowest density was observed during summer 0.74% in males and in winter, 1.61% in females (Table 22). In the other side, the density of lice species showed that moderate population was observed during spring in males with 22.79%, while, in females, the density was 14.52% in spring. In general, high population of rodent ectoparasites were recorded in white bellied rat than in grey rat, this may be due mainly to high numbers of the former than the latter, in addition to its increasing weight and size, wholly in agreement with results obtained by **Embarak (1997)**, **Krasnov *et al*. (2003) and Hawlena *et al*. (2007) .**

3.3.3.1. Effect of relative humidity and temperature on the abundance of ectoparasites extracted from *A. niloticus* body surface:

Data in Table (23) show the correlation coefficients between the population of *A. niloticus* ectoparasites and the weather factors during 2009/2010. Data revealed that there is a significant negative correlation between the maximum and minimum relative humidity (-0.25*, -0.32*) and lice on males. Fleas population negatively affected by maximum , minimum temperature, mean diurnal temperature and mean night temperature but positively affected by the maximum, minimum relative humidity; correlation coefficient values of which were: $-0.0.48^{*}$, -0.47^{*},0.49*, -0.48*, 0.37^{*} and $.0.33^{*}$, respectively, mites population negatively affected by maximum and minimum relative humidity; correlation coefficient values of which were: -0.45*, -0.36* respectively. Mites population positively affected by maximum and minimum temperature, mean diurnal temperature, mean night temperature, correlation coefficient values of which were: 0.45*,0.39*,0.44*, 0.48* respectively.

In females, lice population negatively affected by the maximum, minimum relative humidity but positively affected by maximum , minimum temperature and mean diurnal temperature; correlation coefficient values of which were: -0.0.63**, -0.62**,0.30*, 0.23*, 0.28* ,respectively**.** Fleas population negatively affected by the maximum, minimum relative humidity but positively affected by maximum, minimum temperature, mean diurnal temperature and mean night temperature; correlation coefficient values of which were -0.0.52**, -0.51**,0.31*, 0.27*, 0.30*, 0.22*,respectively**.** Mites population negatively affected by the maximum relative humidity but positively affected by maximum, minimum temperature, mean diurnal temperature and mean night temperature; correlation coefficient values of which were -0.0.25*, 51**,0.61**, 0.63**, 0.58**, respectively**.**

Table (14) Seasonal and monthly abundance of some ectoparasites collected from the body surface of *Rattus rattus frugivorus*, of the Faculty of Agriculture, Assiut University during, 2007-2009.

Ectoparasites / Months	Male of rat parasites (%)				Female of rat parasites (%)				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
Dec.	0.84	0	5.06	5.91	0.78	0	3.52	4.30	5.07
Jan.	0	0.42	2.95	3.38	0.39	0.39	1.17	1.95	2.64
Feb.	5.49	2.11	2.11	9.70	2.34	1.56	2.34	6.25	7.91
Winter	**6.33**	**2.53**	**10.13**	**18.99**	**3.52**	**1.95**	**7.03**	**12.50**	**15.62**
March	7.59	4.22	1.27	13.08	3.52	3.52	3.91	10.94	11.97
April	5.49	2.95	0.84	9.28	3.91	3.91	1.95	9.77	9.53
May	1.27	3.38	0.42	5.06	4.69	2.34	0.78	7.81	6.49
Spring	**14.35**	**10.55**	**2.53**	**27.42**	**12.11**	**9.77**	**6.64**	**28.52**	**27.99**
June	4.22	2.53	3.38	10.13	2.73	3.52	3.13	9.38	9.74
July	2.95	2.53	1.69	7.17	1.56	3.13	0.78	5.47	6.29
Aug.	2.95	0.84	2.53	6.33	0.78	2.34	3.13	6.25	6.28
Summer	**10.13**	**5.91**	**7.59**	**23.63**	**5.08**	**8.98**	**7.03**	**21.09**	**22.31**
Sept.	2.11	1.69	3.80	7.60	1.56	0.78	2.73	5.08	6.29
Oct.	5.49	0.84	4.22	10.55	19.53	0.39	3.52	23.44	17.24
Nov.	5.06	1.27	5.49	11.81	4.69	0	4.69	9.38	10.55
Autumn	**12.66**	**3.80**	**13.50**	**29.96**	**25.78**	**1.17**	**10.94**	**37.89**	**34.08**
Total	43.46	22.78	33.76	100	46.48	21.88	31.64	100	100

Table (15) Seasonal and monthly abundance of some ectoparasites collected from the body surface of *Rattus rattus frugivorus*, of the Faculty of Agriculture, Assiut University during, 2009 - 2010.

Ectoparasites / Months	Male of rat parasites (%)				Female of rat parasites (%)				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
Dec.	1.53	1.53	4.59	7.65	0.82	3.81	2.18	6.81	7.10
Jan.	0.51	2.04	1.02	3.57	1.36	5.99	1.63	8.99	7.10
Feb.	8.67	4.08	3.57	16.33	1.63	1.63	1.09	4.36	8.53
Winter	**10.71**	**7.65**	**9.18**	**27.55**	**3.81**	**11.44**	**5.18**	**20.44**	**22.91**
March	7.65	2.55	2.04	12.24	5.18	2.72	1.09	8.99	10.12
April	5.61	5.10	1.53	12.24	6.54	2.18	3.54	12.26	12.26
May	3.57	2.04	2.55	8.16	1.91	3.54	2.18	7.63	7.82
Spring	**16.84**	**9.69**	**6.12**	**32.65**	**13.62**	**8.45**	**6.81**	**28.88**	**30.20**
June	4.59	0.51	0	5.10	1.36	1.09	0.54	3	3.73
July	3.06	0	0.51	3.57	1.63	1.63	1.09	4.36	4.09
Aug.	2.04	0	0	2.04	1.09	2.45	1.63	5.18	4.09
Summer	**9.69**	**0.51**	**0.51**	**10.71**	**4.09**	**5.18**	**3.27**	**12.53**	**11.90**
Sept.	5.10	1.53	2.55	9.18	6.81	3.27	1.63	11.72	10.83
Oct.	7.14	2.55	2.04	11.73	8.45	4.63	3.00	16.08	14.56
Nov.	1.02	3.57	3.57	8.16	3.54	2.18	4.63	10.35	9.59
Autumn	**13.27**	**7.65**	**8.16**	**29.08**	**18.80**	**10.08**	**9.26**	**38.15**	**34.99**
Total	50.51	25.51	23.98	100	40.33	35.15	24.52	100	100

Table (16) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from *Rattus rattus frugivorus*, of the Faculty of Agriculture, Assiut University during, 2007-2009.

Ectoparasites / weather factors	Male of rat parasites				Female of rat parasites				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
X1	0.35	0.14	-0.079	0.046	0.24*	0.32*	0.034*	0.33*	0.26*
X2	-0.048	0.071	0.013	0.014	0.22*	0.28*	-0.012	0.28*	0.21
X3	0.058	-0.45*	0.43*	0.092	-0.078	-0.63**	0.46*	-0.14	-0.070
X4	-0.14	-0.65**	0.59**	-0.067	0.069	-0.80**	0.42*	-0.19	-0.16
X5	0.034	0.18	0.12	0.042	0.24*	0.38*	-0.016	0.33*	0.26*
X6	-0.040	0.18	-0.14	-0.030	0.14	0.40*	-0.072	0.23*	0.16

Table (17) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from *Rattus rattus frugivorus*, of the Faculty of Agriculture, Assiut University during, 2009-2010.

Ectoparasites / weather factors	Male of rat parasites				Female of rat parasites				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
X1	0.12	-0.45*	-0.62**	-0.30*	0.20	-0.44*	-0.14	-0.064	-0.18*
X2	0.060	-0.55**	-0.62**	-0.38*	0.14	-0.45*	-0.18	-0.12	-0.26*
X3	-0.31*	0.17	0.42*	0.010	-0.19	0.44*	0.15	0.071	0.057
X4	-0.45*	0.018	0.31*	-0.17	-0.32*	0.40*	0.086	-0.051	-0.11
X5	0.094	-0.52**	-0.65**	-0.35*	0.16	-0.44*	-0.19	0.11	0.24*
X6	-0.088	-0.63**	-0.80**	-0.56**	0.12	-0.23*	-0.26*	-0.12	-0.34*

X1= max temperature X2= min temperature X3= max relative humidity X4= min relative humidity
X5= mean diurnal temperature X6= mean night temperature * significant ** highly significant

Table (18) Seasonal and monthly abundance of some ectoparasites collected from the body surface of *Rattus r. alexandrines*, of the Faculty of Agriculture, Assiut University during 2007-2009.

Ectoparasites / Months	Male of rat parasites (%)				Female of rat parasites (%)				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
Dec.	1.16	2.89	2.31	6.36	0.99	1.97	2.46	5.42	5.85
Jan.	0	0.58	1.16	1.73	0.49	0	0.99	1.47	1.60
Feb.	0.58	0.58	2.31	3.47	0.49	0	0.49	0.99	2.13
Winter	**1.73**	**4.05**	**5.78**	**11.56**	**1.97**	**1.97**	**3.94**	**7.88**	**9.58**
March	1.16	1.16	6.36	8.67	2.96	0.99	9.85	13.80	11.44
April	6.94	1.16	6.94	15.03	4.43	1.48	10.84	16.75	15.96
May	5.78	0	8.09	13.87	4.93	2.46	5.91	13.30	13.56
Spring	**13.87**	**2.31**	**21.39**	**37.57**	**12.32**	**4.93**	**26.60**	**43.85**	**40.96**
June	2.31	4.05	13.29	19.65	1.97	2.96	2.96	7.88	13.29
July	1.73	2.89	7.51	12.14	0.99	3.45	3.94	8.37	10.11
Aug.	1.16	0.58	5.20	6.94	0	0	1.48	1.48	3.99
Summer	**5.20**	**7.51**	**26.01**	**38.73**	**2.96**	**6.40**	**8.37**	**17.73**	**27.39**
Sept.	0	0.58	0.58	1.16	0.99	0.49	5.42	6.90	4.25
Oct.	1.16	1.16	0.58	2.89	0.99	1.48	8.87	11.32	7.45
Nov.	3.47	2.31	2.31	8.09	0	2.96	9.36	12.32	10.37
Autumn	**4.62**	**4.05**	**3.47**	**12.14**	**1.97**	**4.93**	**23.65**	**30.54**	**22.07**
Total	25.43	17.92	56.65	100	19.21	18.23	62.56	100	100

Table (19) Seasonal and monthly abundance of some ectoparasites collected from the body surface of *Rattus r. alexandrines*, of the Faculty of Agriculture, Assiut University during, 2009 - 2010.

Ectoparasites	**Male of rat parasites (%)**				**Female of rat parasites (%)**				
Months	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites +Ticks	Total	G. Total
Dec.	0	0	2.88	2.88	3.31	0.55	0.55	4.42	3.75
Jan.	0	0	0.72	0.72	1.10	0	0.55	1.66	1.25
Feb.	1.44	0	0.72	2.16	0	0.55	3.31	3.87	3.13
Winter	**2.16**	**0**	**3.60**	**5.76**	**4.42**	**1.10**	**4.42**	**9.94**	**8.13**
March	5.76	1.44	2.88	10.07	1.10	3.31	7.73	12.15	11.25
April	7.91	3.60	5.76	17.27	4.97	3.87	8.84	17.68	17.50
May	2.88	6.47	8.63	16.55	7.73	3.87	4.42	21.55	19.38
Spring	**16.55**	**11.51**	**17.27**	**45.32**	**13.81**	**11.05**	**20.99**	**45.86**	**45.63**
June	0	2.88	0	2.88	1.10	1.66	2.21	4.97	4.06
July	2.16	0	0	2.16	0	0	1.10	1.10	1.56
Aug.	6.47	4.32	0	10.79	0	0	1.10	1.10	5.31
Summer	**7.91**	**7.19**	**0**	**15.11**	**1.10**	**1.66**	**4.42**	**7.18**	**10.63**
Sept.	1.44	0	11.51	12.95	0.55	0	0	0.56	5.94
Oct.	0	0	17.27	17.27	7.73	4.97	1.66	14.36	15.63
Nov.	2.16	0	1.44	3.60	16.02	5.52	0.55	22.10	14.06
Autumn	**3.60**	**0**	**30.22**	**33.81**	**24.31**	**10.50**	**2.21**	**37.02**	**35.63**
Total	30.22	18.71	51.08	100	43.65	24.31	32.04	100	100

Table (20) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from *Rattus r. alexandrines*, of the Faculty of Agriculture, Assiut University during, 2007-2009.

Ectoparasites / weather factors	Male of rat parasites				Female of rat parasites				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
X1	0.28*	0.006	0.41*	0.38*	0.24*	0.13	0.14	0.20*	0.33*
X2	0.16n	0.12	0.39*	0.35*	0.099	0.24*	0.085	0.15	0.28*
X3	-0.38*	-0.30*	-0.76**	-0.71**	-0.44*	-0.57**	0.035	-0.30*	-0.58*
X4	-0.48*	-0.19*	-0.83**	-0.78**	0.61**	-0.43*	0.18	0.42*	-0.68**
X5	0.30*	0.069	0.47*	0.44*	0.26*	0.21	0.16	0.24*	0.39*
X6	0.21*	0.080	0.49*	0.43*	0.22*	0.20	0.057	0.15	0.33*

Table (21) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from *Rattus r. alexandrines*, of the Faculty of Agriculture, Assiut University during 2009-2010.

Ectoparasites / weather factors	Male of rat parasites				Female of rat parasites				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
X1	0.25*	0.48*	0.24*	0.46*	-0.084	0.044	-0.013	-0.005	0.19
X2	0.19	0.39*	0.18	0.35*	-0.098	0.007	-0.10	0.068	0.10
X3	-0.20	-0.66**	-0.30*	-0.53**	0.004	-0.26*	-0.33*	-0.27*	-0.42*
X4	-0.24*	-0.67**	-0.42*	-0.65**	0.042	-0.35*	-0.42*	-0.36*	-0.54**
X5	0.20	0.45*	0.20	0.40*	0.11	0.10	-0.050	-0.046	0.14
X6	0.096	0.38*	0.13	0.27*	-0.20*	-0.13	-0.19	-0.19	-0.021

X1= max temperature X2= min temperature X3= max relative humidity X4= min relative humidity
X5= mean diurnal temperature X6= mean night temperature * significant ** highly significant

Table (22) Seasonal and monthly abundance of some ectoparasites collected from the body surface of *Arvicanthis niloticus*, of the Faculty of Agriculture, Assiut University during, 2009 - 2010.

Ectoparasites	**Male of rat parasites (%)**				**Female of rat parasites (%)**				
Months	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites +Ticks	Total	G. Total
Dec.	0.74	5.15	2.21	8.09	1.61	0	2.69	4.30	5.90
Jan.	0	2.21	2.94	5.15	0.54	0.54	1.08	2.15	3.42
Feb.	0.74	0	0	0.74	0	1.08	2.15	3.23	2.17
Winter	**1.47**	**7.35**	**5.15**	**13.97**	**2.15**	**1.61**	**5.91**	**9.68**	**11.49**
March	3.68	0.74	2.21	6.62	1.61	0.54	0.54	2.69	4.35
April	13.97	1.47	8.09	23.53	4.84	1.61	1.61	8.06	14.60
May	5.15	2.21	1.47	8.82	8.06	3.76	0.54	12.37	10.87
Spring	**22.79**	**4.41**	**11.76**	**38.97**	**14.52**	**5.91**	**2.69**	**23.12**	**29.81**
June	0.74	0	6.62	7.35	6.45	3.23	6.99	16.67	12.37
July	0.74	0	3.68	4.41	1.08	1.08	14.52	16.67	11.49
Aug.	2.21	0.74	5.88	8.82	0	0.54	5.38	5.91	7.14
Summer	**3.68**	**0.74**	**16.18**	**20.59**	**7.53**	**4.84**	**26.88**	**39.25**	**31.37**
Sept.	2.21	1.47	1.47	5.15	1.61	0	1.61	3.23	4.04
Oct.	4.41	2.94	2.21	9.56	2.15	2.15	7.53	11.83	10.87
Nov.	8.82	2.21	0.74	11.76	5.91	3.76	3.23	12.90	12.42
Autumn	**15.44**	**6.62**	**4.41**	**26.47**	**9.68**	**5.91**	**12.37**	**27.96**	**27.33**
Total	43.38	19.12	37.50	100	33.87	18.28	47.85	100	100

Table (23) Correlation coefficient (r) between six weather factors and the abundance of the collected ectoparasites from *Arvicanthis nilotucus*, of the Faculty of Agriculture, Assiut University during 2009-2010.

Ectoparasites / weather factors	**Male of rat parasites**				**Female of rat parasites**				
	Lice	Fleas	Mites+Ticks	Total	Lice	Fleas	Mites+Ticks	Total	G. Total
X1	0.11	-0.48*	0.45*	0.15	0.30*	0.31*	0.51**	0.60**	0.53**
X2	0.017	-0.47*	0.39*	0.061	0.23*	0.27*	0.61**	0.64**	0.51**
X3	-0.25*	0.37*	-0.45*	-0.28*	-0.63**	-0.52**	-0.25*	-0.63**	-0.62**
X4	-0.32*	0.33*	-0.36*	-0.31*	-0.62**	-0.51**	-0.091	-0.51**	-0.54**
X5	0.041	-0.49*	0.44*	0.95	0.28*	0.30*	0.56**	0.63**	0.52**
X6	-0.090	-0.48*	0.48*	0.019	0.18n	0.22*	0.58**	0.58**	0.44*

X1= max temperature X2= min temperature X3= max relative humidity X4= min relative humidity
X5= mean diurnal temperature X6= mean night temperature * significant ** highly significant

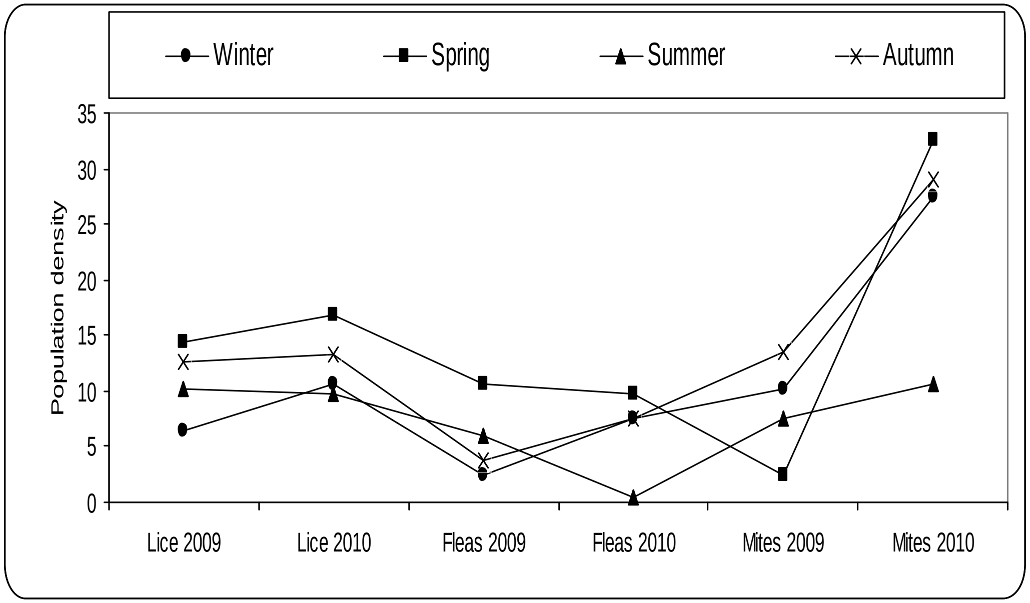


Fig. (10) Seasonal abundance of some ectoparasites collected from males of *Rattus r. frugivorus* in farm animals of the Agriculture Faculty, Assiut University during, 2009-2010.

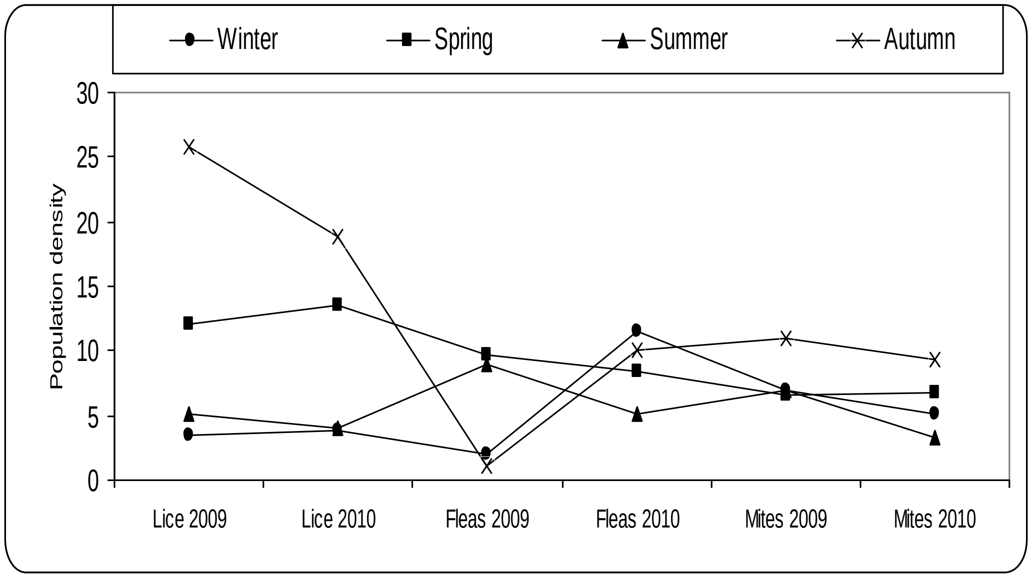


Fig.(11)Seasonal abundance of some ectoparasites collected from females of *Rattus r. frugivorus* in farm animals of the Agriculture Faculty, Assiut University during, 2009-2010.

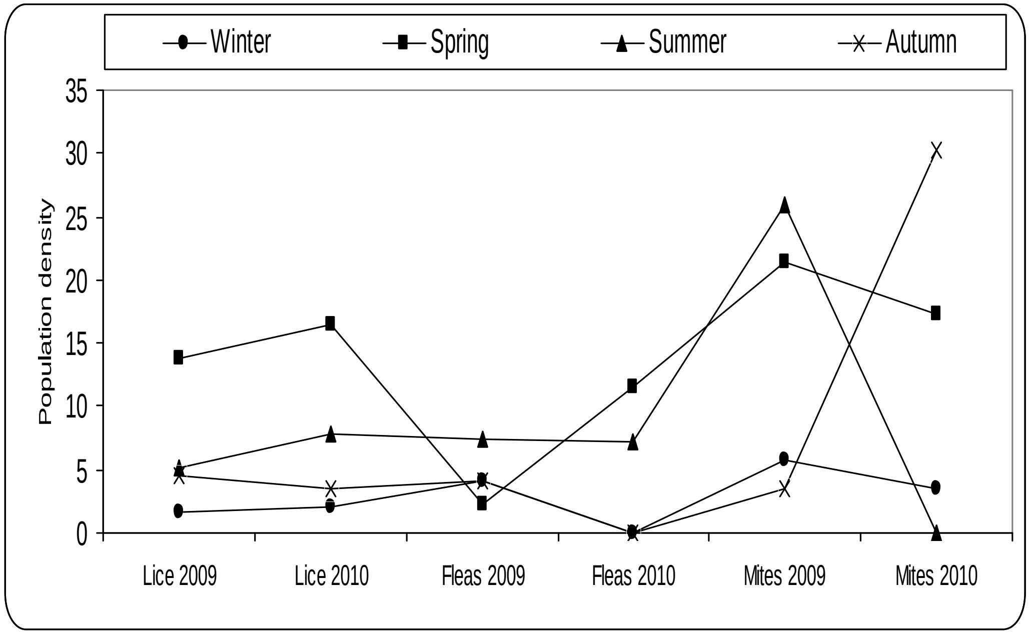


Fig.(12)Seasonal abundance of some ectoparasites collected from males of *Rattus r. alexandrinus* in farm animals of the Agriculture Faculty, Assiut University during, 2009-2010.

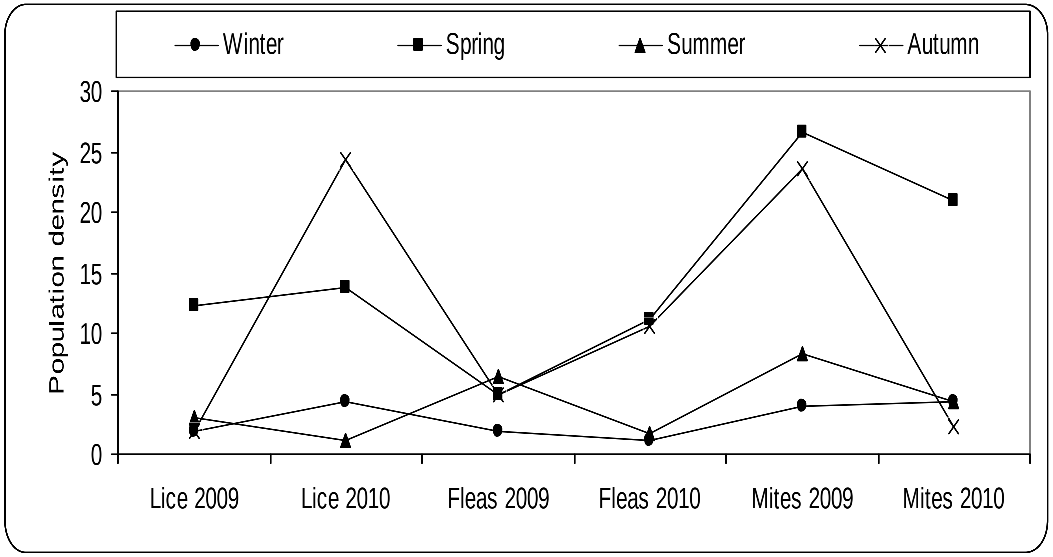


Fig.(13)Seasonal abundance of some ectoparasites collected from females of *Rattus r. alexandrinus* in farm animals of the Agriculture Faculty, Assiut University during, 2009-2010.

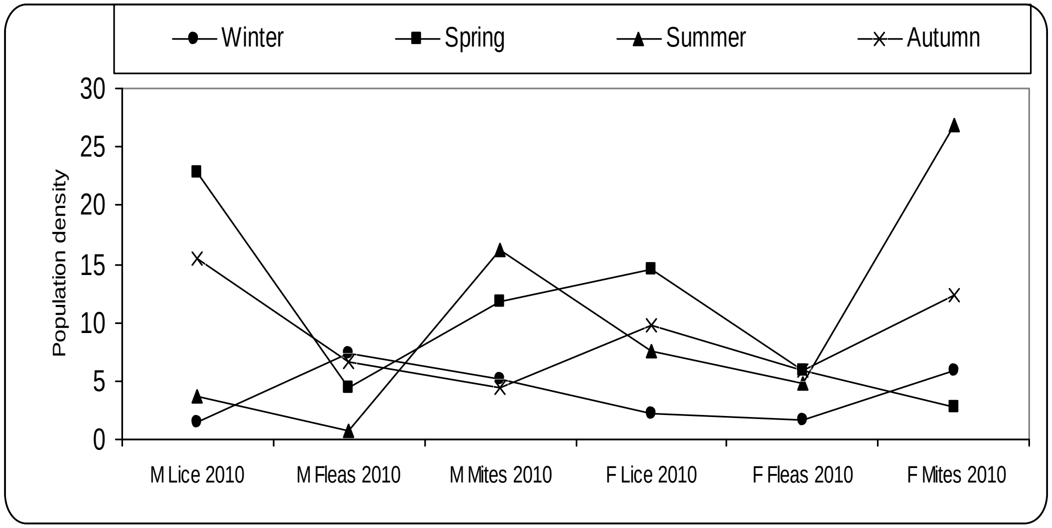


Fig. (14) Seasonal abundance of some ectoparasites collected from *A.niloticus*, in farm animals of the Agriculture Faculty Assiut University during, 2009-2010.

CHAPTER (3)

STUDIES ON CERTAIN ECTOPARASITES ASSOCIATED WITH SOME FARM ANIMALS AND THEIR CONTROL

RESULTS AND DISCUSSION

4. Control studies:

4.1. Control of ectoparasites in animal:

4.2. Control of mange

4. Control studies:

4.1. Control of ectoparasites in animal:

4.1.1. Localization density of ectoparasites on the animal body surface:

This work was carried out to determine the population distribution of various ectoparasites on animal body regions. Animal body includes three regions, the front region was the head, neck and front legs, the second region was the area between legs, and the third region was the back area including the back legs.

Data in Table (24) and figure (15) show the distribution of lice stages on buffalo body surface. Results showed a significant difference between lice (eggs, nymph and adults) on buffalo body regions. The population density of eggs was higher than other stages in front region, the population density of adult was higher than eggs and nymphs in medium region, but the population of nymphs were higher than eggs and adults in back region. This may be due to nature of buffalo skin and **increasing the length** of **hairs in the front region, also increasing the nymphs in the back region** may be **due to the smooth skin in this region, this makes it easier for nymphs with the small piercing sucking mouth parts** to **feed.**

Data in Table (25) and figure (16) showed the distribution of ticks on cattle body surface, the results showed difference between population of ticks on cattle for body surface. The population density of ticks was high in back region. This may be due to **the weakness of the skin thickness on the posterior region of the animal**.This study means the distribution of parasites on animal body (surface and abdomen) during day periods such as (morning period, noon period and evening period), This may be due to to escape of parasites from the hot period of the day .

Data in Table (26) and figures (17 and 18) showed the distribution of buffalo lice and cattle ticks on body region during day time. Results showed significant difference between the distributions of buffalo lice. The population density of lice was high in the morning period on surface region but for abdomen region it was in noon period. Whereas the population density of cattle ticks on body region during daytime, show also a significant difference between cattle tick populations. The population density of ticks was in high numbers in abdomen body **Milnes *et al.* (2003)**. This may be because of the farness from the temperature that concentrated in the posterior abdominal **prefering the back and side abdominal** region **especially for easy absorption of blood**. **Hussain *et al*.(2005)** found that there are several factors related to environment and host, which contribute to lice infestation (e.g., poor nutrition, intensity of sunlight, temperature, humidity, crowding, management conditions, host-skin reaction, hair condition, hair length and shedding, animal grooming, licking, physiological resistance, breeds, etc.).

Table (24) Distribution of lice on buffalo body surface

Body region	Front region			Medium region			Back region		
Stages	Stages			Stages			Stages		
	Egg	Nymph	Adult	Egg	Nymph	Adult	Egg	Nymph	Adult
Mean	49.60 a	10.80f	42.20b	21.20d	17.60de	34.80c	5.00g	22.80d	15.80ef

Table (25) Distribution of ticks on cattle body surface

Region / Rep.	Front region	Medium region	Back region
1	6	4	28
2	7	3	31
3	5	9	30
Mean	6A	5.33A	29.67 B

Table (26) Distribution of lice and ticks on the animal body surface during the day time.

Parasites / Periods	Buffaloes lice		Cattle ticks	
	Surface region	Abdomen region	Surface region	Abdomen region
	1	2	1	2
Morning	63 a	10.33 e	9 e	38 bc
Noon	30 cd	37 bc	7.33 e	36.67 bc
Evening	44.33 b	21.67 d	5 e	34 c

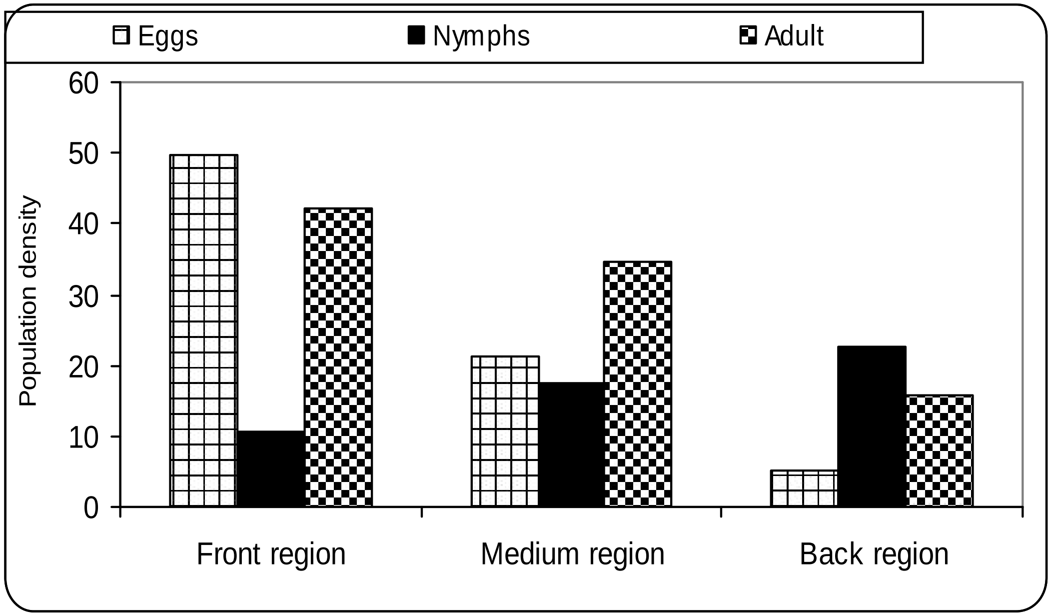


Fig.(15) Distribution of lice on buffalo body surface.

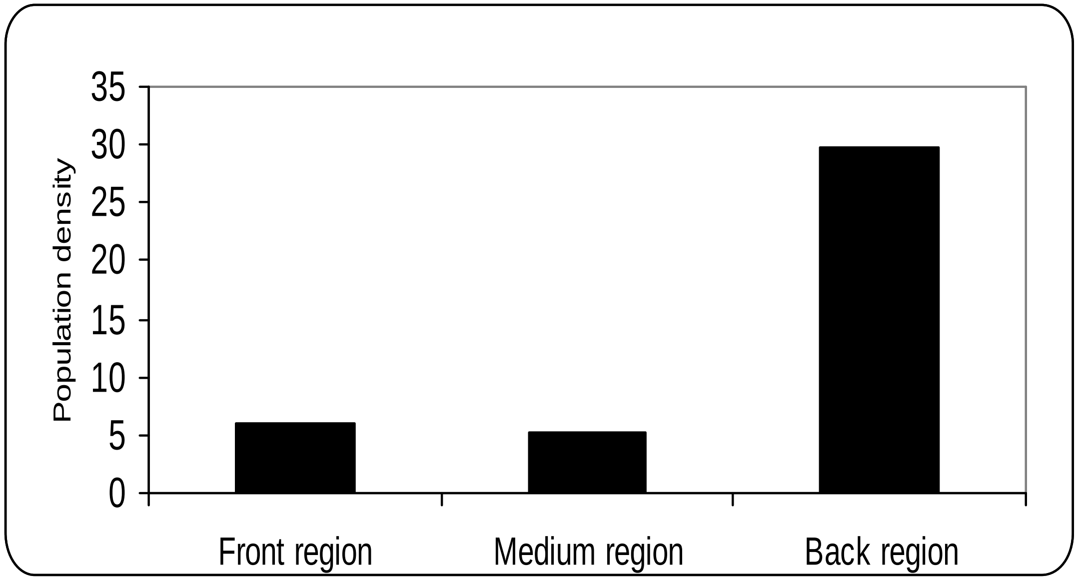


Fig.(16) Distribution of ticks on cattle body surface**.**

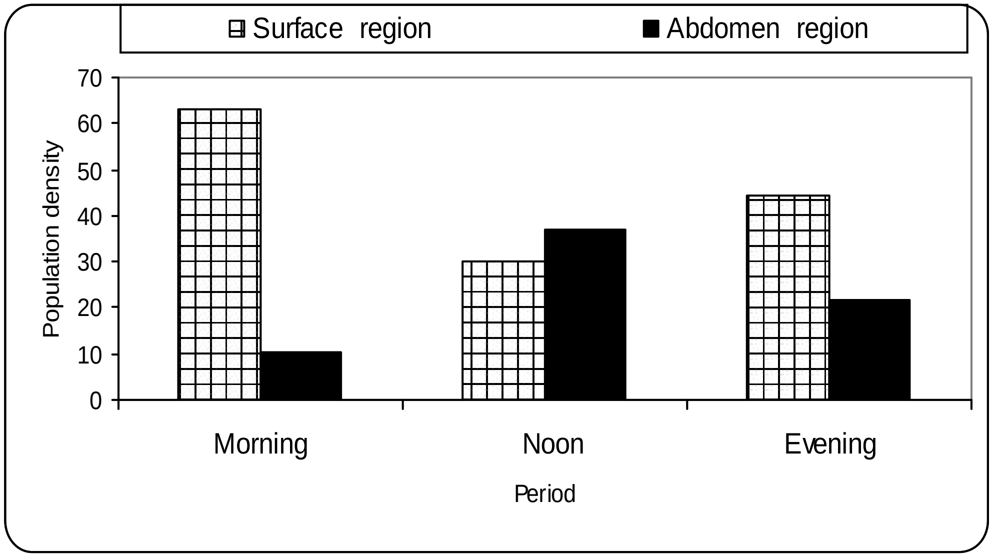


Fig.(17) Distribution of lice on buffalo body surface during the day time.

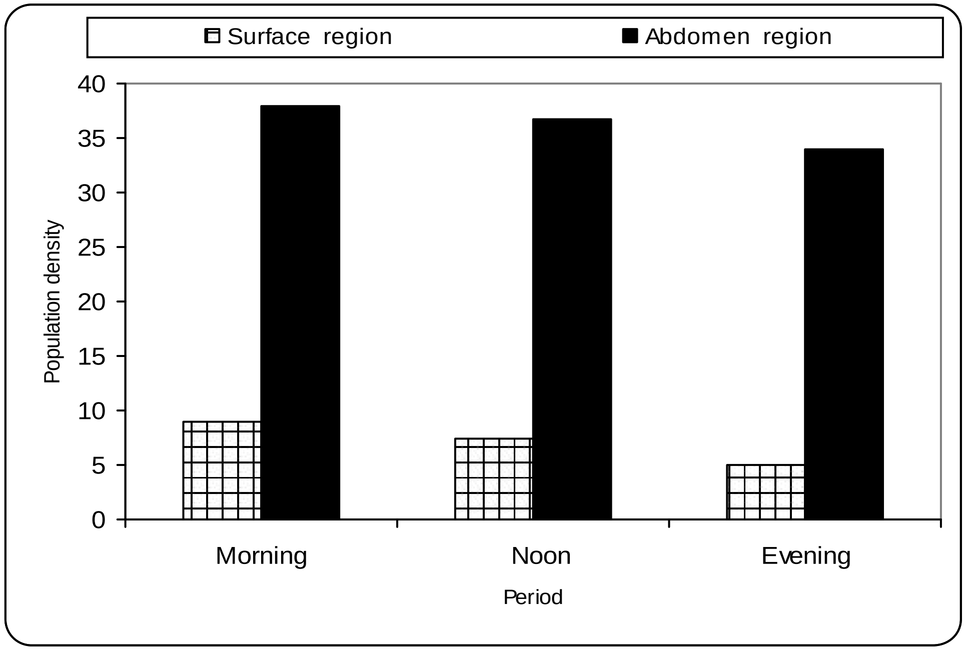


Fig.(18) Distribution of ticks on cattle body surface during the day time.

4.1.2. In animals:

Data in Tables (27 and 28) and figures (19 and 20) represented the percentage of mortality in animal ectoparasites after one to 45 days from applications with Diazinon 15% EC spray at 1ml/liter water. Results showed that after one day, the post treatment gave an initial kill of 34.78%, 25.87%, and 10% in buffaloes, cattle and sheep-parasites, respectively. The activity of the product increased gradually to attain 50.37%, 55.95% and 23.08%, respectively after 5 days from treatment. By time the activity of the product decreased gradually to attain 26.18%, 18.59% and 10.31%, after 20 days for the above mentioned three animals, respectively. However after 45 days, the mortality percentage of ectoparasites reduced to be 10.19%, 3.43% and 1.86%, respectively (Table 27).

Diazinon 60% EC spray at 1ml/liter water, gave an initial kill of 40.58%, 36.46% and 22.85% after 24 hrs in buffalo, cattle and sheep parasites, the activity of the product increased gradually to attain 80.52%, 55.31% and 64.12% in buffalo, cattle and sheep-parasites after 7 days respectively. The activity of the product decreased gradually to attain 63.76%, 33.92% and 49.06% after 20 days, respectively. However after 45 days the percentage of mortality reduced to be 20.38%, 11.65% and 30.40% for the three animals parasites, respectively (Table 28 and figure 20).

In general the Diazinon product showed variable toxicity to animals parasites .According to the percentage of mortality recorded after 24hrs and 45 days, Diazinon 60% EC showed the highest toxicity, followed by Diazinon 15% EC, this may be due to the increasing of active ingredient in Diazinon 60% EC, the same results were obtained with **Abo Elmaged (1998) and Rajput *et al*. (2006).**

Data in Tables (29 and 30) and figures (21 and 22) represented the percentage of mortality in animal ectoparasites after one to 45 days from applications with Vertimec 1.8% EC spray at 1ml/liter water. Results showed that after one day, the post treatment gave initial kill of 32.35% in buffalo parasites, 55.96% in cattle parasites and 28.57% in sheep parasites. The activity of the product increased gradually to attain 78.77%, 81.48% and 56.94% for the parasite of three animals after 7 days, respectively. After 20 days, the activity of the product decreased gradually to attain 59.90%, 52.46% and 56.13%, respectively. However after 45 days the percentage of mortality reduced to be 39.03%, 36.13% and 32.60% for animal parasites, respectively (Table 29).

Butox 5% EC spray at 1ml/liter water caused initial kill of 47.33% in buffalo-parasites, 59.19% in cattle-parasites and 51.50% in sheep parasites. The activity of the product increased gradually to attain 84.93%, 85.42% and 76.59% in buffaloes, cattle and sheep parasites after 7 days, respectively. After 20 days of treatment, the activity of the product decreased gradually to attain 71.88%, 58.03% and 62.50% for the parasites of the animals respectively. However, after 45 days the percentage of mortality reduced to be 42.24%, 34.46% and 43.92% for the three animals-parasites, respectively (Table 30 and figure 22). The present results agreed with those obtained by **Mehlhorn *et al*. (2010)**.

In general the Butox5% product showed variable toxicity to animal parasites .According to the percentage of mortality recorded after 24 h and 45 days, Butox5% EC showed the highest toxicity, followed by Vertimec 1.8% EC and Diazinon 60% EC.

Ivermectin 1% (Injection) at 1 ml/50 kg caused initial kill to 63.77%, 67.89% and 12.69% in buffalo, cattle in sheep parasites after 24 hrs. The activity of the product increased gradually to attain 98.05%, 97.22% and 77.21% in buffalo, cattle and sheep parasites after 7 days, after so the activity of the product decreased gradually to attain 78.53%, 64.76% and 37.50% after 20 days, respectively. However, after 45 days the percentage of mortality reduced to be 35.03%, 34.20% and 13.08% for the three animals parasites, respectively (Table 31 and figure 23).

In general the Ivermectin 1% injection product showed variable toxicity to animals parasites .According to the percentage of mortality recorded after 24 h to 45 days, Ivermectin 1% injection showed the highest toxicity, followed by Vertimec 1.8% EC, the results were in agreement with the finding of **Hussain *et al*.(2005) and Ramzan *et al.* (2008)**.

Table (27) Reduction ratios of animal ectoparasites after spraying with Diazinon 15% EC (1ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

Days	**Mean ±SE (%)**		
	Buffalo parasites	**Cattle parasites**	**Sheep parasites**
1	34.78± 1.28 ef	25.87 ±2.08 gh	10.00 ± 1.18 o-q
3	46.51 ± 1.37 bc	41.46 ± 2.15 cd	20.12 ± 1.14 i-l
5	50.37 ±3.29 ab	55.95 ± 3.21 a	23.08 ± 1.13 h-j
7	48.70± 2.38 b	44.68 ± 2.17 bc	17.88± 0.99 k-m
10	37.25± 1.16 de	26.67 ± 1.96 gh	13.68 ± 0.54 m-o
15	29.61 ±2.42 fg	24.26 ± 1.71 g-i	11.98 ± 0.53 n-q
20	26.18± 2.46 gh	18.59 ± 2.39 j-l	10.31 ± 0.91 o-q
25	21.98 ±1.63 h-k	12.50 ± 2.94 n-p	9.40± 0.87 p-r
30	15.68 ±2.01 l-n	8.15 ± 0.75 qr	6.03 ± 0.51 r
45	10.19 ±1.13 o-q	3.43 ± 1.21 s	1.86 ± 0.78 s
Mean	32.13 A	26.16 B	12.43 C

- Means followed by the same letter are insignificantly different.

Table (28) Reduction ratios of animal ectoparasites after spraying with Diazinon 60% EC (1ml/L) under field conditions, in farm-animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

Days	**Mean ±SE(%)**		
	Buffalo parasites	**Cattle parasites**	**Sheep parasites**
1	40.58 ± 0.74 jk	36.46 ± 2.08 kl	22.85 ± 1.01 n
3	50.39 ± 2.09 gh	53.65 ± 3.29 fg	38.15 ± 0.91 j-l
5	66.67 ± 1.31 bc	66.67 ± 1.21b	46.00 ± 0.88 hi
7	80.52 ± 1.15 a	55.31 ± 1.88 ef	64.12± 1.69 cd
10	79.10 ± 1.76a	40.00 ± 1.96jk	69.81 ± 0.48 b
15	69.74 ± 0.67b	34.95 ± 2.62kl	61.06 ± 0.85 d
20	63.76 ± 1.18 cd	33.92 ± 0.91 lm	49.06 ±0.83 gh
25	59.86 ± 0.69 de	22.50 ±1.47 n	42.25 ± 0.83 ij
30	39.56 ± 1.32 jk	17.04 ± 0.75o	36.44± 0.48 kl
45	20.38 ± 2.83 no	11.65 ± 1.21p	30.40 ±1.19 m
Mean	57.06 A	37.22 C	46.01 B

- Means followed by the same letter are insignificantly different.

Table (29) Reduction ratios of animal ectoparasites after spraying with Vertimec 1.8% EC (1ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

Days	**Mean ±SE (%)**		
	Buffalo parasites	**Cattle parasites**	**Sheep parasites**
1	32.35± 2.82 mn	55.96 ± 1.62 fg	28.57 ± 2.10 n
3	41.35 ± 1.33 k	69.70± 1.78 bc	42.27 ± 1.39 jk
5	65.76 ± 1.85 cd	73.07 ± 1.93 b	50.00 ± 1.35 hi
7	78.77 ± 1.85 a	81.48 ± 0.94 a	56.94 ± 0.85 fg
10	80.43 ± 0.96 a	67.33 ± 1.75 de	62.26 ± 1.27 de
15	70.39 ± 1.14 b	57.14 ± 1.68 fg	71.15 ± 0.85 b
20	59.90 ± 2.31 ef	52.46 ± 2.21 gh	56.13 ± 0.83 fg
25	50.58 ± 2.34 hi	46.45 ± 2.12 ij	43.66 ± 0.83 jk
30	41.77 ± 2.08 jk	42.36 ± 3.08 jk	39.72 ± 0.83 kl
45	39.03 ± 1.89 kl	36.13 ± 2.28 lm	32.60 ± 0.78 mn
Mean	56.03 b	58.21 a	48.33 c

- Means followed by the same letter are insignificantly different.
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Table (30) Reduction ratios of animal ectoparasites after spraying with Butox 5% EC, (1ml/L) under field conditions, in farm-animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

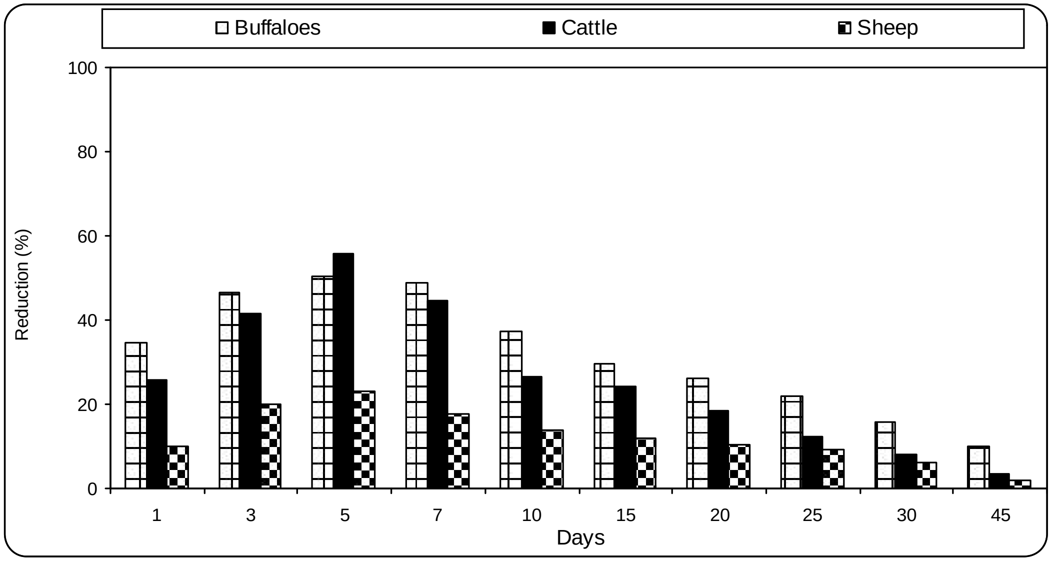
Days	**Mean ±SE(%)**		
	Buffalo parasites	**Cattle parasites**	**Sheep parasites**
1	47.33 ± 1.35 mn	59.19± 1.04 i-k	51.50 ± 2.01 lm
3	63.91± 2.65 h	76.34± 1.10 de	62.41 ± 1.91 h-j
5	76.71 ± 0.70 de	83.33± 1.96 bc	68.92 ± 1.82 g
7	84.93 ±1.85 ab	85.42 ±1.06 ab	76.59 ± 0.65 de
10	86.96 ± 0.96 a	75.51 ± 1.80 ef	81.48 ± 1.09 c
15	79.89 ± 2.61 cd	61.39 ±1.75 h-j	70.25 ± 2.33 g
20	71.88 ±0.92 fg	58.03 ± 0.91 jk	62.50 ± 1.05 h-j
25	62.64 ± 1.55 hi	48.72 ± 1.51 m	55.74 ± 0.96 kl
30	48.83 ± 1.04 m	37.84 ± 1.59 pq	49.29 ± 1.28 m
45	42.24 ± 0.94 op	34.46 ± 1.48 q	43.92 ± 0.82 no
Mean	66.53 a	62.02 b	62.26 b

- Means followed by the same letter are insignificantly different.

Table (31) Reduction ratios of animal ectoparasites after Ivermectin 1%, (1m/50kg, injection) under field conditions, Farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	Mean ±SE(%)		
	Buffalo parasites	**Cattle parasites**	**Sheep parasites**
1	63.77± 1.95 jk	67.89 ± 2.47 h-j	12.69 ± 2.63 s
3	82.17 ± 2.09 ef	74.75 ± 2.72 gh	25.53 ± 2.50 r
5	93.33 ± 2.61 bc	88.01 ± 1.76 de	73.65 ± 2.39 g-i
7	98.05 ± 1.15 a	97.22 ± 1.64 a	77.21 ± 2.23 fg
10	94.12± 1.15 b	89.01± 2.69 cd	68.52 ± 1.09 h-j
15	88.82 ± 2.42 d	78.10 ± 2.57 fg	52.53 ± 1.11 lm
20	78.53 ± 2.46 fg	64.76 ± 2.21 j	37.50 ± 1.05 n-p
25	66.67 ± 1.83 ij	58.26 ± 2.12 kl	28.42 ± 1.47 qr
30	44.03 ± 1.31 mn	43.05 ±1.87 no	21.32 ± 1.28 r
45	35.03± 1.12 o-q	34.20 ± 1.14 pq	13.08 1.65 s
Mean	74.45 a	69.53 b	41.05 c

- Means followed by the same letter are insignificantly different.



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- Fig.(19) Reduction ratios of animal ectoparasites after spraying with Diazinon 15% EC (1ml/L) under field conditions, in farm-animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

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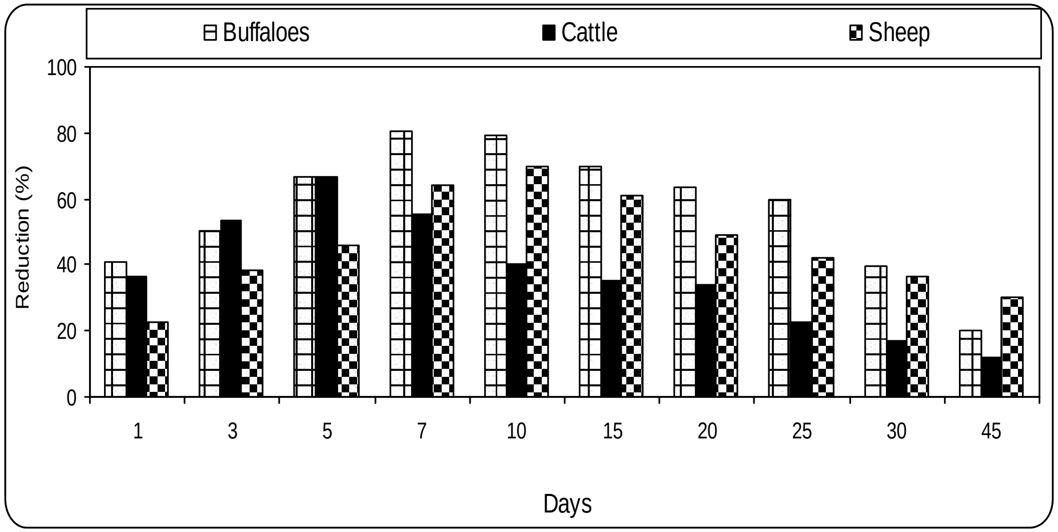

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- Fig (20) Reduction ratios of animal ectoparasites after spraying with Diazinon 60% EC (1ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

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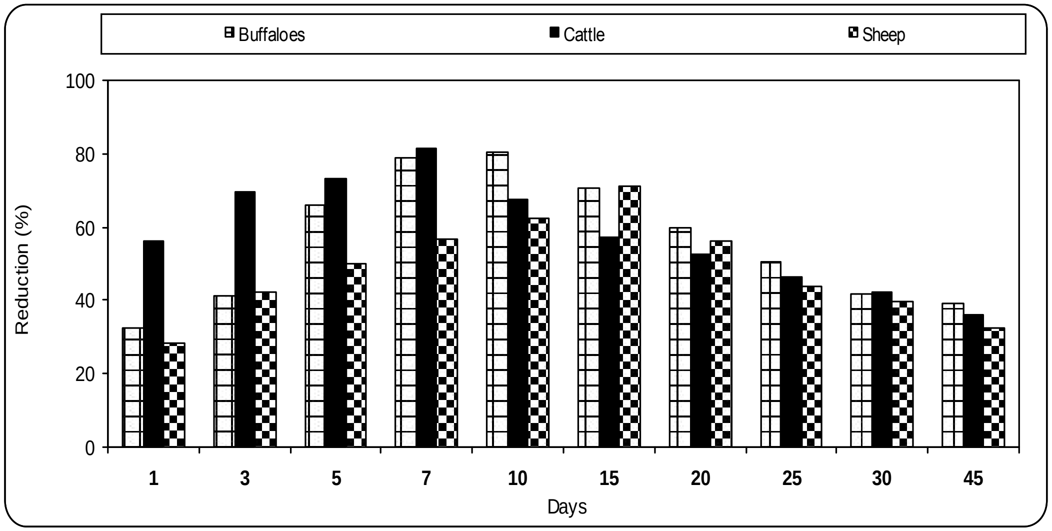

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- Fig. (21) Reduction ratios of animal ectoparasites after spraying with Vertimec 1.8% EC (1ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

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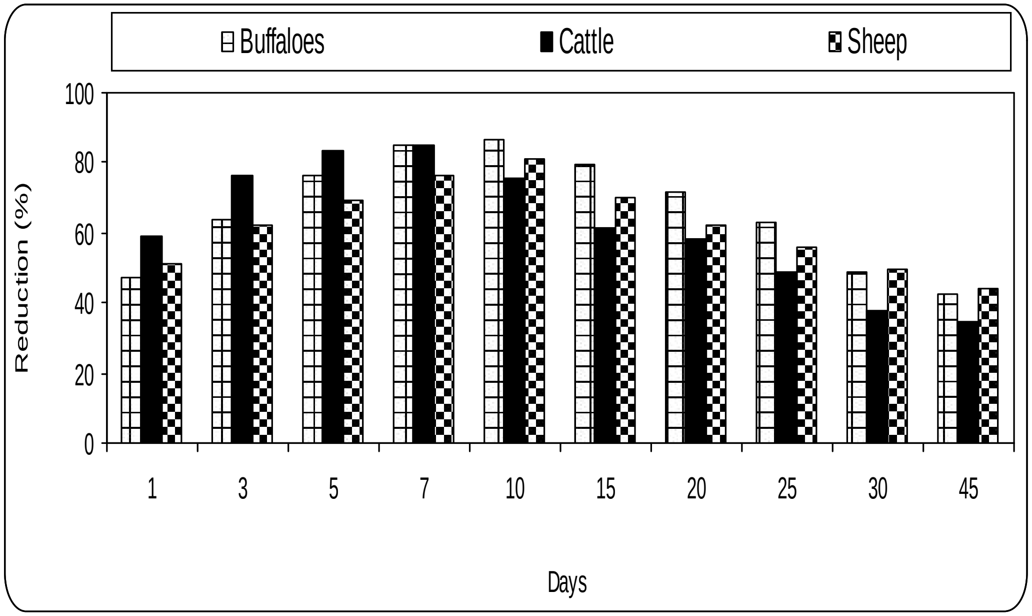

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- Fig.(22) Reduction ratios of animal ectoparasites after spraying with Butox 5% EC (1ml/L) under field conditions in farm-animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

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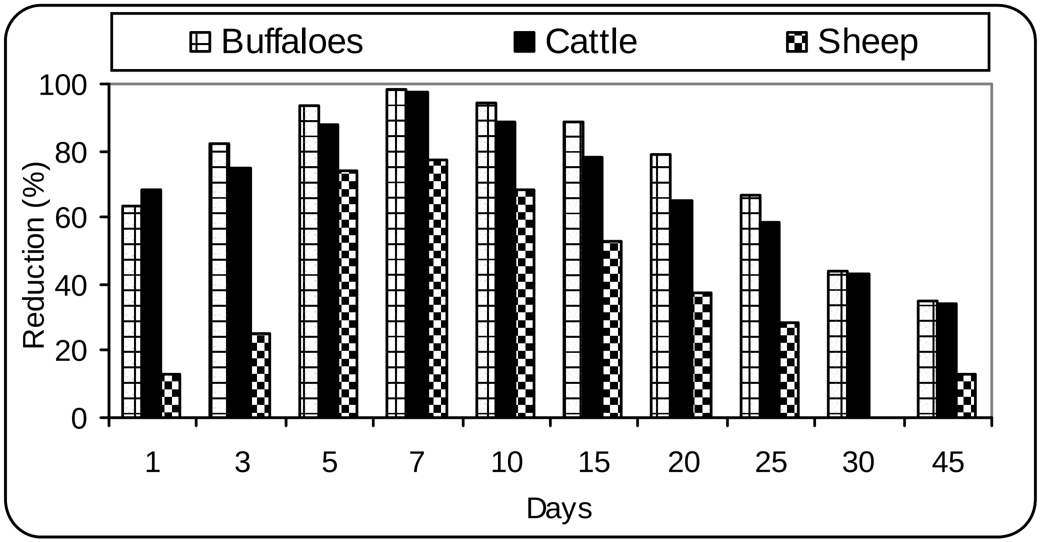

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- Fig. (23) Reduction ratios of animal ectoparasites after Ivermectin 1%, (1m/50kg, injection) under field conditions in farm-animals, Faculty of Agriculture, Assiut University, during, 2009-2010.

Data in Table (32) and figure (24) represented the percentage of mortality to animal ectoparasites after one to 45 days after applications of Diazinon 60% EC spray at 1.5ml/liter. Results showed that after one day, the post treatment gave an initial kill of 43.75% and 54.43% in buffalo and cattle parasites. The activity of the product increased gradually after 7days to attain 84.40% and 82.91% in buffalo and cattle parasites. The activity of the product decreased gradually to attain 54.61%, 56.63% after 20 days, respectively. However after 45 days the percentages of mortality reduced to be 38.51%, 26.19% for buffalo and cattle, respectively.

Diazinon 60% EC spray at 2ml/liter water, caused an initial kill of 51.12% and 64% in buffaloes and cattle parasites. The activity of the product increased gradually to attain 87.13% and 88% in buffalo and cattle parasites after 7 days, after so the activity of the product decreased gradually to attain 77.63%, 74.22% after 20 days, respectively. However after 45 days the percentages of mortality reduced to be 51.67%, 43.88% for the two animals parasites, respectively (Table 32 and figure 25).

Data in Table (33) and figure (26) represented the percentage of mortality in animal ectoparasites after one to 45 days of applications with Vertimec 1.8% EC spray at 1.5ml/liter, caused an initial kill of 54.17% and 63.71% in buffalo and cattle parasites after 24 hrs. The activity of the product increased gradually to attain 89.82% and 85.47% in buffalo and cattle parasites after 7days, after so the activity of the product decreased gradually to attain 68.42% and 61.45%, after 20 days. However, after 45 days the percentage of mortality reduced to be 44.90%, 33.33% for the two animals parasites, respectively.

Vertemic1.8 % EC spray at 2ml/liter caused an initial kill of 64.66% and 70% in buffalo and cattle parasites after 24 hrs. The activity of the product increased gradually to attain 94.74% and 90% in buffalo and cattle parasites after 7days, after so the activity of the product decreased gradually to attain 88.59%, 78.91%, after 20 days of treatment. However, after 45 days the percentage of mortality reduced to be 69.45%, 50.36% for animal parasites of the two animals (figure 27).

In general the Vertimec1.8% EC product showed variable toxicity to animal parasites .According to the percentages of mortality recorded after 24 h and 45 days, Vertimec1.8%EC at 2ml/liter showed the highest toxicity, followed by Vertimec1.8%EC at 1.5ml/liter, in according with results obtained by **Kolar *et al.* (2008).**

- Data in Table (34) and figure (28) represented the percentage of mortality to animal ectoparasites after one to 45 days of the application with Butox 5% EC spray at 1.5ml/liter, results showed that after one day post treatment gave an initial kill of 61.46% and 66.30% in buffalo and cattle parasites. The activity of the product increased gradually to attain 86.24% and 85.31% in buffalo and cattle parasites after 7 days, after so the activity of the product decreased gradually to attain 72.18% and 67.82%, after 20 days. However, after 45 days the percentage of mortality reduced to be 47.29%, 39.53% for the two animals parasites, as similar as **Bossche and Mudenge (1999).**
- Butox 5% EC spray at 2ml/liter caused an initial kill of 73.38% and 72.92% in buffalo and cattle parasites. The activity of the product increased gradually to attain 91.89% and 93.46% in buffalo and cattle parasites after 7days, after so the activity of the product decreased gradually to attain 93.13%, 81.85%, after 20 days. However, after 45 days the percentage of mortality reduced to be 67.86% and 55.96% for the two animals parasites. The obtained results are in agreement with the finding of **Mehlhorn *et al*. (2009)** who found that, the Deltamethrin containing product of Butox® protected sheep and cattle against midges, which suck blood at the legs or at the belly for at least 4 weeks, even if the animal becomes wet several times during these 4–5 weeks,(Figure 29)

  In general the Butox5% EC product showed variable toxicity to animal parasites .According to the percentage of mortality recorded after 24h and 45 days, Butox5% EC at 2ml/liter water showed the highest toxicity, followed by Butox 5% EC at 1.5ml/liter.

Data in Table (35) and figure (30) represented the percentage of mortality in sheep-ectoparasites after one to 30 days from the application with Butox 5% at 1ml/liter on woolly and fleeced-sheep. Results show that, the one day post treatment gave an initial kill of 91.51% for fleas on fleeced-sheep and 51.50% on woolly sheep. The activity of the product increased gradually to attain 100% and 76.59% for fleas on the former sheep after 7 days, after so the activity of the product decreased gradually to attain 79.5% and 62.50% after 20 days. However, after 30 days the percentage of mortality reduced to be 70.43% and 55.74% for fleas on fleeced and woolly sheep.

In general, according to the percentage of mortality recorded after 24h and 30 days, the fleas on fleeced-sheep showed the highest toxicity, followed by fleas on woolly sheep when used Butox 5% EC at 1ml/liter.

Data in Table (36) and figure (31) represented the percentage of mortality in animal ectoparasites after one to 30 days from the application with Radiant 12 % SC spray at 4ml/liter water. Results showed that, after one day post treatment gave an initial kill of 22.50% and 14.10% in buffalo and sheep-parasites. The activity of the product increased gradually to attain 54.62% and 22.92% in buffalo and sheep-parasites after 5 days .However after 30 days the percentage of mortality reduced to be 57.14%, 15.42% for buffalo and sheep-parasites.

Radiant 12% SC spray at 6 ml/liter, caused an initial kill 35.83% and 21.47% after 24 hrs in buffalo and sheep parasites. The activity of the product increased gradually to attain 62.8% and 28.02% in the two animals parasites. After so, the activity of the product decreased gradually to attain 65.18% and 39.61%, after 30 days (Figure 32).

In general the Radiant 12% SC 6ml/liter showed variable toxicity to animal parasites .According to the percentage of mortality recorded after 24h and 30 days, Radiant12% SC at 6ml/liter water showed the highest toxicity, followed by Radiant12% SC at 4ml/liter.

- The results of using Radiant 12 % SC spray at 8ml/liter, showed that, after one day post treatment the compound gave an initial kill of 45.83%, 29.99% and 30.06% in buffalo, cattle and sheep parasites respectively. The activity of the product increased gradually to attain 81.08%, 64.71% and 55.41% in buffalo, cattle and sheep parasites after 5 days respectively, after so the activity of the product decreased gradually to attain 75.89%, 35.25%, and 69.57 after 30 days, respectively (Table 37 and figure 33). In general, Radiant 12%SC at 8cm/liter showed the highest toxicity, followed by Radiant 12% at 6cm/liter.

Data in Table (38) represented the percentage of mortality for hard ticks on cattle from one to 30 days after applications of Radiant 12 % SC spray at 6, 8 and 12 ml/liter water. Results showed that, the one day post treatment the compound gave an initial kill of 15.99%, 29.99% and 40.99% with Radiant12% SC sprayed at 6, 8 and12ml/L. The activity of the product increased gradually to attain 48.04, 64.71 and 66.67% for ticks on cattle parasites after 5days, respectively. Then the activity of the product decreased gradually to attain 13.12%, 35.25%, and 55.74% after 30 days respectively. These results agreed with those obtained by **El Kady *et al*. (2007)**. In general, Radiant12% SC at 12ml/liter showed the highest toxicity, followed by Radiant 12% at 6 and 8 ml/liter for control of ticks infested cattle.

Diazinon 60% EC spray and or in contact methods at 1ml/liter caused an initial kill of 39.13% and 56.52% in control of buffalo parasites and 37.61% and 50.45% in control of cattle ones, after 24 hrs. The activity of the product increased gradually to attain 78.57% and 86.36% after 7 days with spray and contact method in buffaloes parasites, also 68% after 5 days with spray method and 80.56% after 7 days with contact method in cattle parasites, after so the activity of the product decreased gradually to attain 59.73%, 77.85%, 34.43% and 65.58% after 20 days, respectively. However after 45 days the percentage of mortality reduced to be 31.21%, 43.31%, 16.78% and 43.92% for animal parasites, respectively (Table 39 and figure 34). In general, contact method was the best produced high toxicity, followed by spray method for the control of animal parasites control.

- Table (32) Reduction ratios of animal ectoparasites after spraying with Diazinon 60% EC (1.5 and 2ml/L) under
- field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	**Mean ±SE (%)**			
	1.5 ml/L		**2 ml/L**	
	Buffalo parasites	**Cattle parasites**	**Buffalo parasites**	**Cattle parasites**
1	43.75 ± 1.84 k	54.43 ± 1.49 ij	51.12 ± 2.02 j	64.00 ± 1.76 h
3	56.88 ±1.87 i	73.33± 1.57 ef	69.50 ± 0.72 g	75.79 ± 1.07 f
5	78.38 ± 1.59 cd	80.49 ± 1.44 bc	82.47 ± 1.14 cd	82.35 ± 1.73 cd
7	84.40 ± 1.87 a	82.91± 0.87 ab	87.13 ± 1.58 ab	88.00± 1.76 ab
10	75.22 ±0.90 de	69.44± 1.63 fg	89.76 ± 0.61 a	88.57 ± 1.68 bc
15	62.30 ± 2.07 h	65.85 ± 1.44 gh	85.88 ± 1.04 b	80.33 ± 1.45 de
20	54.61 ± 2.08 ij	56.63 ± 1.42 ij	77.63 ± 0.60 ef	74.22 ± 1.38 f
25	51.70 ± 1.83 j	45.24 ± 1.40 kl	68.85 ± 0.96 g	60.00 ± 1.47 hi
30	46.10 ± 2.60 k	36.59 ±1.43 m	63.10 ± 0.94 h	56.82 ±1.34 i
45	38.51 ±1.82 lm	26.19 ± 1.40n	51.67 ± 0.98 j	43.88 ± 1.27 k
Mean	59.19 a	59.11a	72.71 a	71.40 b

- In the same concentration, means followed by the same letter are insignificantly different

- Table (33) Reduction ratios of animal ectoparasites after spraying with Vertimec 1.8% EC (1.5 and 2ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	**Mean ±SE (%)**			
	1.5ml/L		**2ml/L**	
	Buffalo parasites	**Cattle parasites**	**Buffalo parasites**	**Cattle parasites**
1	54.17± 2.81 ij	63.71± 2.28 gh	64.66 ± 1.53 j	70.00 ± 1.76 h-j
3	71.79 ± 0.93 ef	78.67 ± 1.57 cd	73.76 ± 1.91 g-i	75.79 ± 2.84 gh
5	82.88 ± 2.43 bc	83.74 ± 0.83 b	88.31 ±1.15 cd	87.26 ± 1.00 de
7	89.82 ± 0.84 a	85.47± 0.87 b	94.74 ±1.03 b	90.00 ± 1.02 cd
10	85.85 ± 0.91ab	74.07± 0.94 d-f	96.97 ± 1.63 a	91.43 ± 1.68 bc
15	76.15 ±0.78 de	70.73± 1.44 de	97.65 ± 0.60 a	87.71 ± 1.44 cd
20	68.42 ± 1.33 fg	61.45 ± 1.42 h	88.59 ± 0.96 cd	78.91 ± 1.38 fg
25	59.18 ±1.20 hi	50.00 ±1.40 jk	82.52 ± 0.56 ef	67.50 ± 1.47 j
30	53.90 ± 1.91 ij	41.46 ± 1.44 l	75.93 ± 0.94 gh	65.91 ± 1.34 j
45	44.90 ± 2.40 kl	33.33 ± 1.40 m	69.45 ± 1.50 ij	50.36 ± 1.27 k
Mean	68.71 a	64.26 b	83.26 a	76.49 b

- In the same concentration, means followed by the same letter are insignificantly different

Table (34) Reduction ratios of animal ectoparasites after spraying with Butox5% (1.5 and 2ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	**Mean ±SE (%)**			
	1.5ml/L		**2ml/L**	
	Buffalo parasites	**Cattle parasites**	**Buffalo parasites**	**Cattle parasites**
1	61.46 ± 2.81 gh	66.30 ± 1.11 fg	73.38 ± 1.42 g	72.92 ± 1.06 g
3	75.23 ±1.62 de	75.26 ± 1.82 de	82.35 ± 1.30 f	81.82 ± 1.78 f
5	81.98 ± 2.43 bc	81.00 ± 1.02 b-d	88.46 ± 1.36 d	92.38 ± 0.97 c
7	86.24 ± 1.62 ab	85.31 ± 1.74 ab	91.89 ± 1.62 c	93.46 ± 0.95 c
10	89.28 ± 1.57 a	88.89 ± 1.64 a	94.45 ± 0.81 bc	96.16 ± 0.98 ab
15	79.23 ± 1.36 cd	75.68 ± 1.59 c-e	97.03 ± 0.67 a	87.18 ± 1.51 de
20	72.18 ± 2.03 ef	67.82 ± 2.34 fg	93.13 ± 1.35 c	81.85 ± 0.86 f
25	63.27 ± 1.20 gh	56.67 ± 3.06 fg	84.09 ± 1.34 ef	76.52 ± 1.54 g
30	56.03 ± 1.45 h	47.15 ± 2.19 i	75.37 ± 1.31 g	64.22 ±1.62 h
45	47.29 ± 1.19 i	39.53 ± 1.37 i	67.86 ± 1.26 h	55.96 ± 1.62 i
Mean	71.22	68.36	84.80 a	80.25 b

- - In the same concentration, means followed by the same letter are insignificantly different

- Table (35) Reduction ratios of fleas on sheep after spraying with Butox 5%EC (1ml/L) with woolly and fleeced sheep under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

Days	**Mean ±SE (%)**	
	Fleeced sheep	**Woolly sheep**
1	91.51 ± 1.66 c	51.50 ± 2.01 j
3	100.00 ±0 a	62.41 ± 1.91 hi
5	100.00 ± 0 a	68.92 ± 1.82 gh
7	100.00 ±0 a	76.59 ± 0.65 ef
10	97.27 ± 1.60 b	81.48 ± 1.09 de
15	85.56 ±1.05 d	70.25 ± 2.33 fg
20	79.05 ± 2.57 e	62.50 ± 1.05 hi
30	70.43 ±2.35 fg	55.74 ± 0.96 ij
Mean	90.48 a	66.17 b

- - Means followed by the same letter are insignificantly different.

Table (36) Reduction ratios of animal ectoparasites after spraying with Radiant 12% SC (4 and 6ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

Days	**Mean ±SE (%)**			
	4ml/L		**6ml/L**	
	Buffaloes	**Sheep**	**Buffaloes**	**Sheep**
1	22.50 ± 1.47 e	14.10 ± 1.65 hi	35.83 ± 2.25 gh	21.47± 1.66 k
3	39.44 ±1.62 c	19.26 ± 1.67 e-g	44.95 ± 1.62 ef	23.70 ± 1.18 jk
5	54.62 ± 2.70 b	22.92 ±0.65 e	62.28 ± 2.37 c	28.02 ± 1.72 ij
10	66.07 ± 2.40 a	19.47 ± 0.93 ef	72.32 ± 0.91 b	50.00 ± 1.07 de
15	67.59 ± 2.49 a	16.92 ± 0.91 f-h	77.78 ± 1.64 a	46.67 ± 1.38 e
30	57.14 ± 1.58 b	15.42 ±1.00 g-i	65.18 ± 1.57 c	39.61 ± 1.30 fg
Mean	39.99 a	13.46 b	59.72 a	34.91 b

- In the same concentration, means followed by the same letter are insignificantly different

Table (37) Reduction ratios of animal ectoparasites after spraying with Radiant 12% SC (8ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

Days	**Mean ±SE (%)**		
	Buffaloes parasites	**Cattle parasites**	**Sheep parasites**
1	45.83 ± 2.25 g	29.99 ± 2.70 h	30.06 ± 1.08 h
3	58.71 ± 1.62 e	47.04 ± 2.92 fg	34.79 ± 1.10 h
5	81.08 ±1.59 b	64.71 ± 1.73 de	55.41 ± 1.72 ef
10	87.50 ± 0.91 a	69.00 ±1.02 cd	68.95 ± 1.42 cd
15	89.82 ± 0.94 a	47.62 ±2.57 fg	77.95 ± 0.52 b
30	75.89 ± 1.58 bc	35.25 ± 1.67 g	69.57 ± 0.85 c
Mean	73.14 a	48.94 c	56.12 b

Means followed by the same letter are insignificantly different.

Table (38) Reduction ratios of ticks on cattle after spraying with Radiant 12% SC using (6,8 and 12ml/L) under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

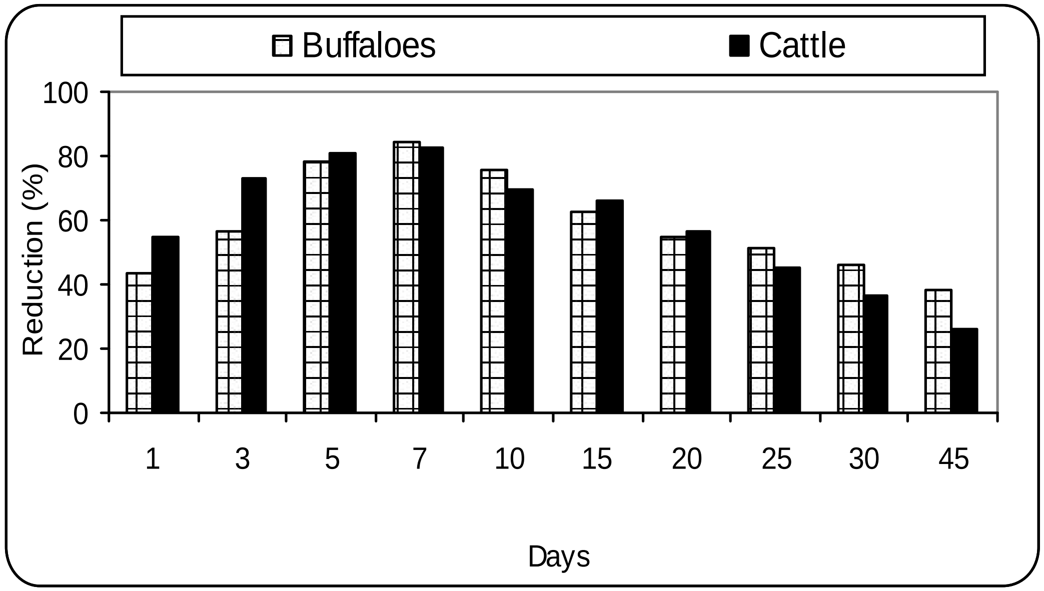
Days	Mean ±SE (%)		
	Radiant 12%SC		
	6ml/L	**8ml/L**	**12ml/L**
1	15.99± 1.76 i	29.99 ± 2.70 h	40.99 ± 3.67 fg
3	35.80 ± 2.84 gh	47.04 ± 2.92 ef	55.79 ± 1.86 de
5	48.04 ± 2.64 f	64.71 ±1.73 cd	66.67 ± 2.00 bc
10	55.00 ± 1.76 de	69.00 ± 1.02 bc	82.00 ± 1.76 a
15	31.43 ± 3.36 h	47.62 ± 2.57 fe	71.43 ± 1.68 b
30	13.12 ± 2.21 i	35.25 ± 1.67 f	55.74 ±1.45 de
Mean	33.23 c	48.94 b	62.10 a

Means followed by the same letter are insignificantly different.

Table (39) Reduction ratios on animal ectoparasites by using washing and spraying method with Diazinon 60% EC at (1ml/L) under field conditions in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	**Mean ±SE (%)**			
	Buffalo parasites		**Cattle parasites**	
	Spraying method	**Contact method**	**Spraying method**	**Contact method**
1	39.13± 1.28 no	56.52± 1.28 h-j	37.61± 0.93 op	50.45± 1.62 lm
3	51.16± 1.37 k-m	67.44± 1.37 f	54.55 ±1.78 i-l	63.64± 1.78 fg
5	64.44± 1.31 gh	77.78± 1.31 cd	68.00 ±1.21 f	73.27± 1.75 e
7	78.57± 1.15 c	86.36± 1.15 ab	58.33 ± 1.63 hi	80.56± 1.63 c
10	74.51± 1.15 de	88.24 ± 1.16 a	49.04 ±1.76 m	85.15 ± 1.75 ab
15	64.48± 1.16 f	84.21± 1.16 b	40.00 ±1.68 no	74.29 ±1.68 de
20	59.73± 1.19 gh	77.85± 1.19 cd	34.43 ± 2.21 pq	65.58± 1.45 f
25	51.02± 1.20 k-m	67.35± 1.20 f	26.77 ±1.39 r	52.75± 1.39 j-m
30	39.56± 1.32 no	55.23± 1.32 h-k	20.83 ± 1.23 s	41.67 ± 1.23 no
45	31.21± 1.13 q	43.31 ± 1.72 n	16.78 ± 1.14 t	32.91± 1.74 q
Mean	55.38 c	70.43 a	40.63 d	62.03 b

Means followed by the same letter are insignificantly different



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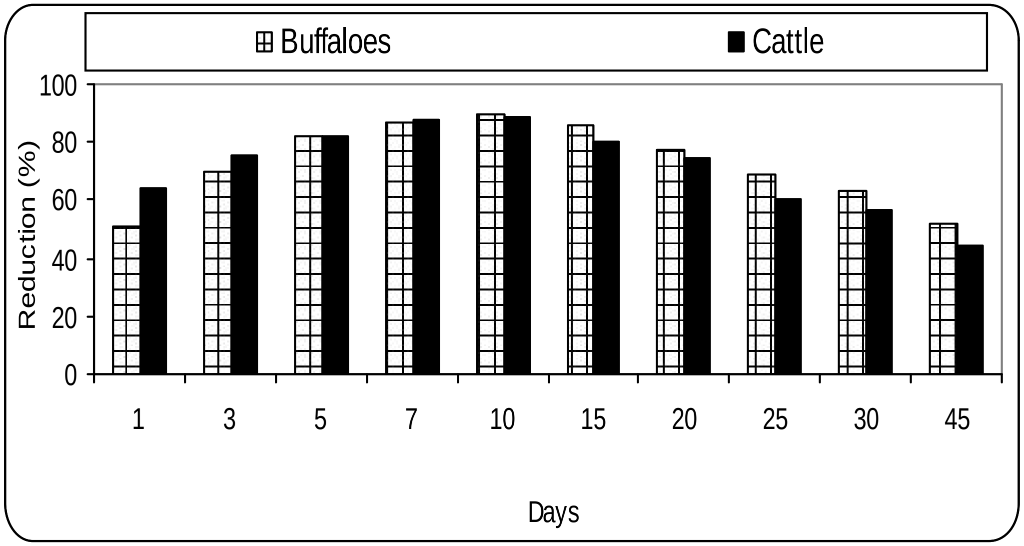
- Fig. (24) Reduction ratios of animal ectoparasites after spraying with Diazinon 60% EC (1.5 ml/L) under field conditions in farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.



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- Fig. (25) Reduction ratios of animal ectoparasites after spraying with Diazinon 60% EC (2 ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University during, 2009-2010.

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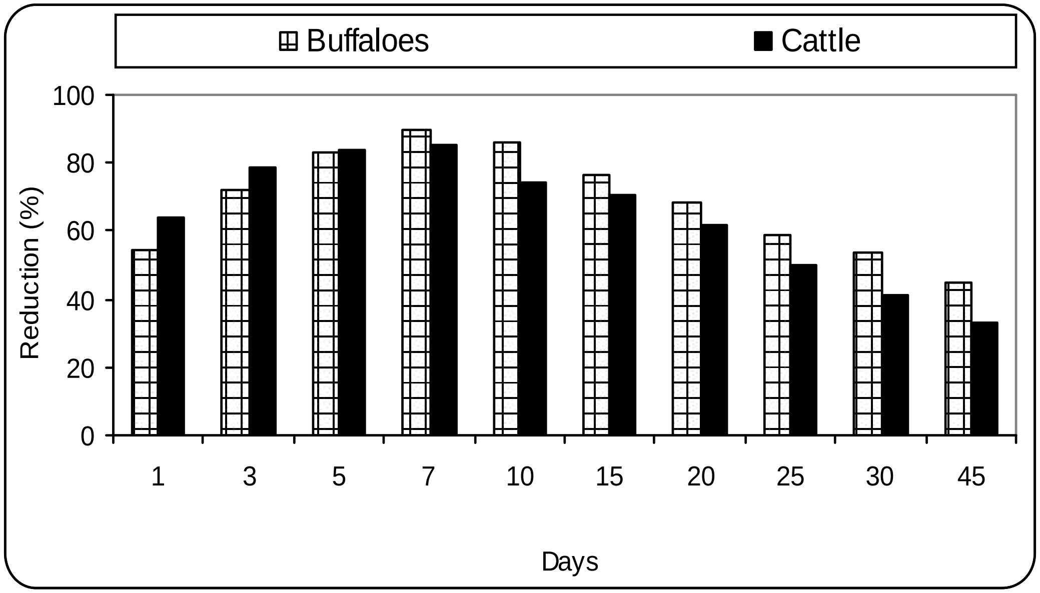

- Fig. (26) Reduction ratios of animal ectoparasites after spraying with Vertimec 1.8% EC (1.5 ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University during, 2009-2010.

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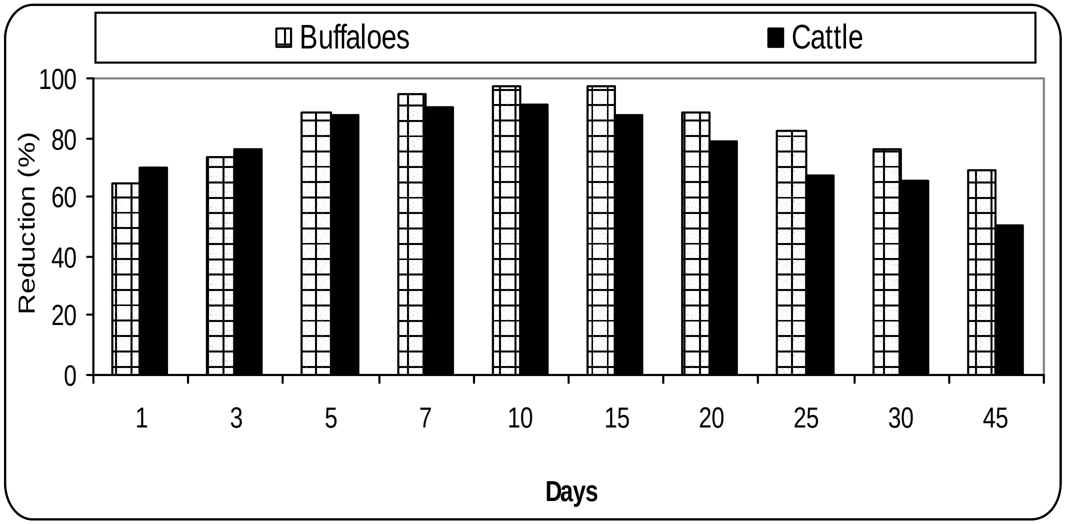

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- Fig. (27) Reduction ratios of animal ectoparasites after spraying with Vertimec 1.8% EC (2ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University during, 2009-2010.

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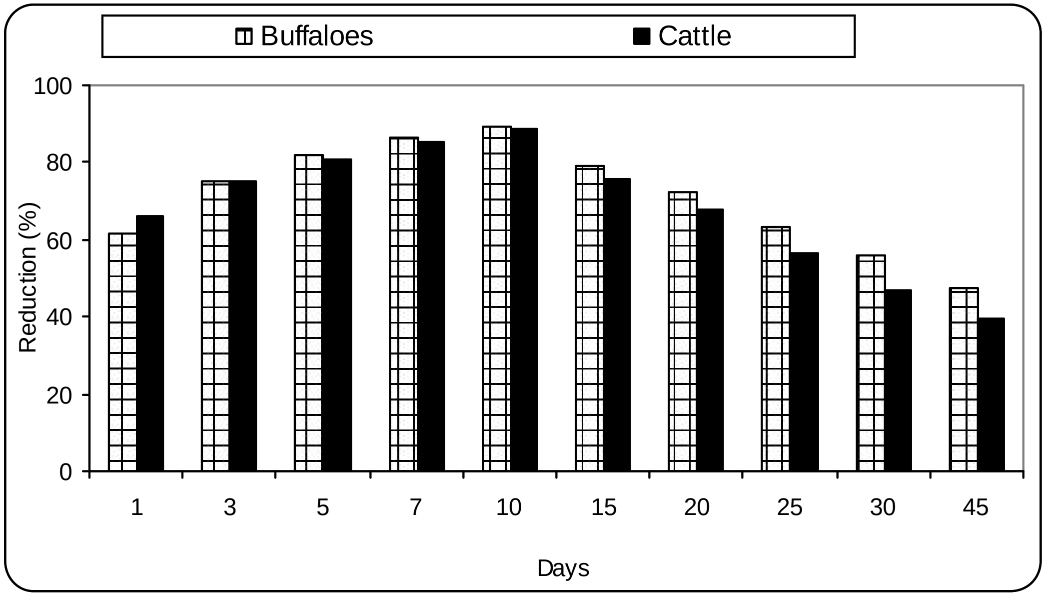

- Fig.(28) Reduction ratios of animal ectoparasites after spraying with Butox5% EC (1.5ml/L) under field conditions, in farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.

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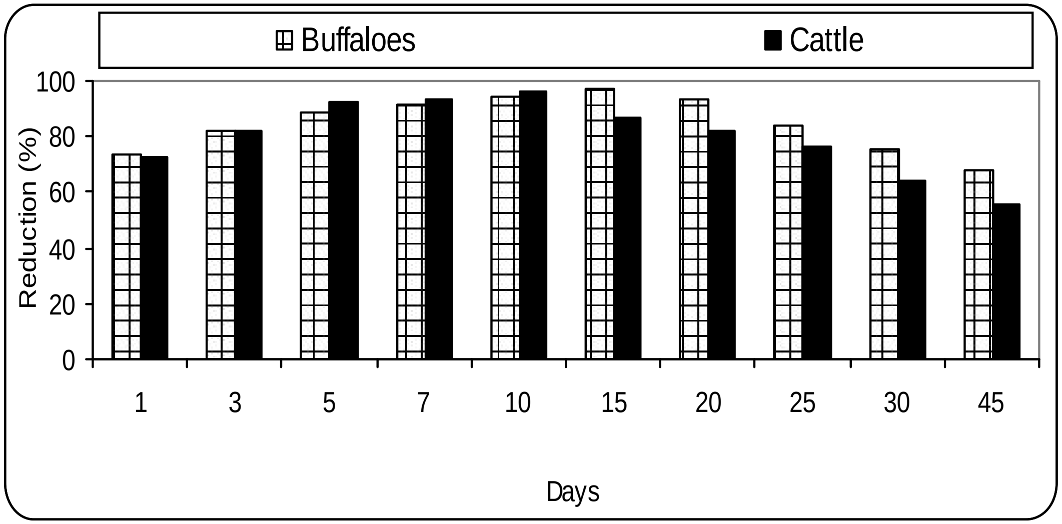

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- Fig.(29) Reduction ratios of animal ectoparasites after spraying with Butox5% EC using (2ml/L) under field conditions in farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.

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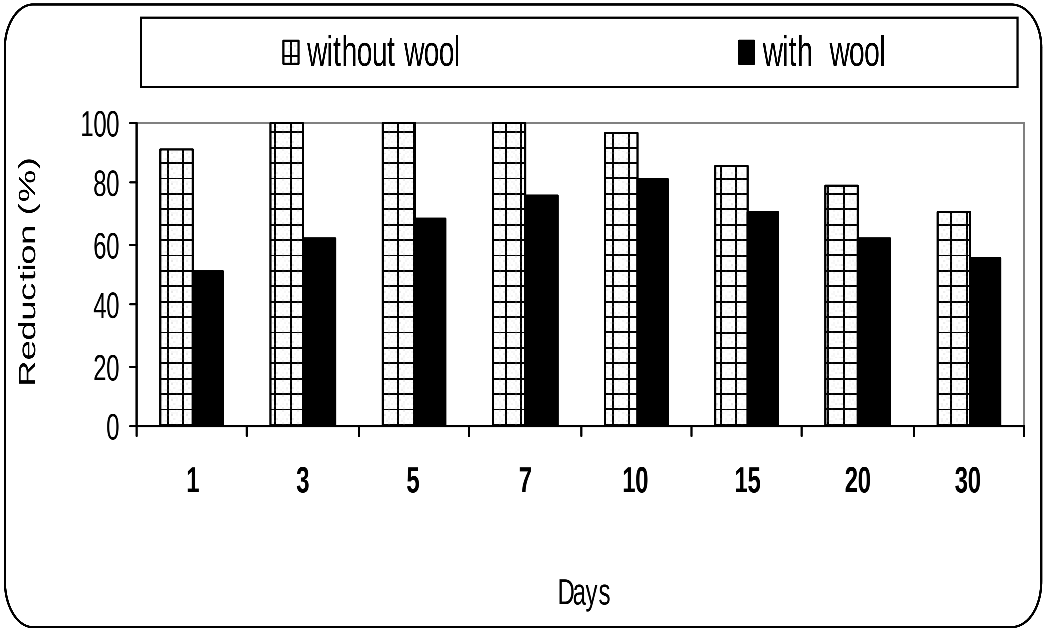

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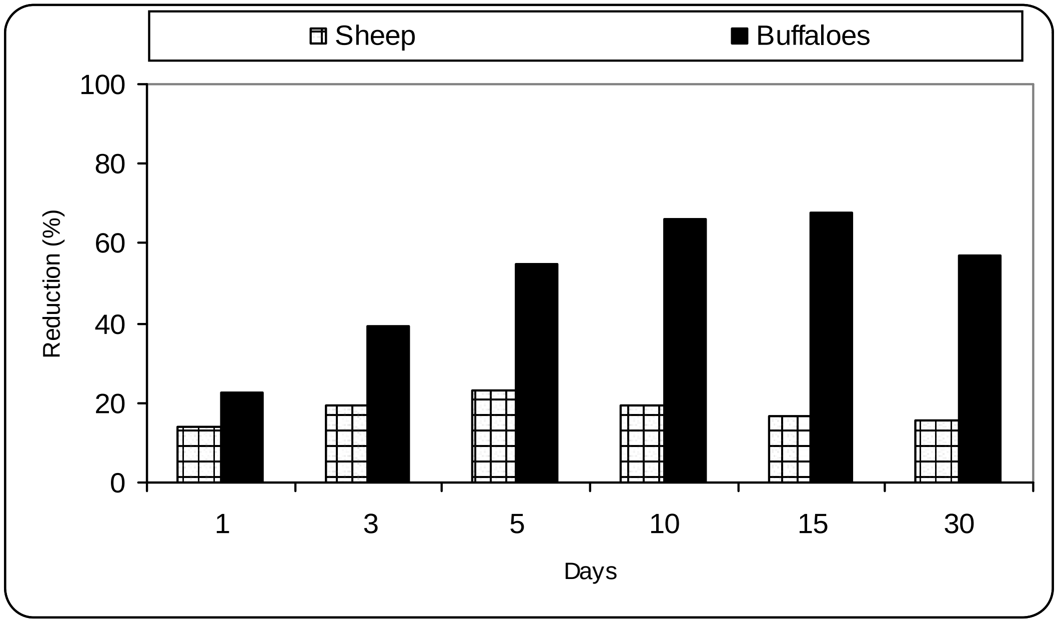
- Fig.(30) Reduction ratios of fleas on sheep after spraying with Butox (1ml/L) with and without wool on sheep under field conditions, farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010 .



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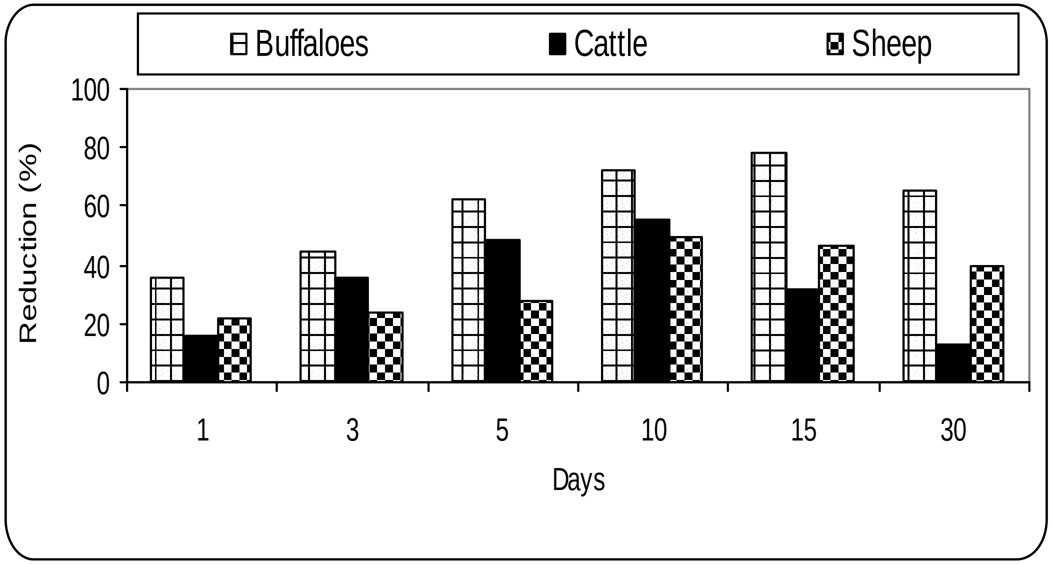
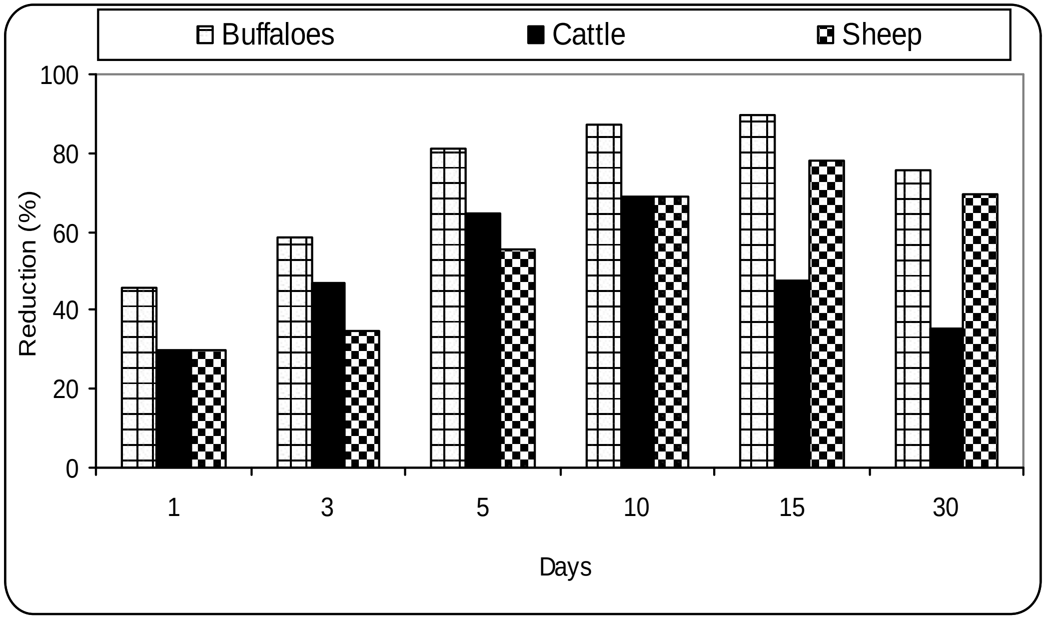
- Fig.(31) Reduction ratios of animal ectoparasites after spraying with Radiant 12% SC using (4ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University during, 2009-2010.



- Fig. (32) Reduction ratios of animal ectoparasites after spraying with Radiant 12% SC (6ml/L) under field conditions, in farm- animals, Faculty of Agriculture, Assiut University during, 2009-2010.



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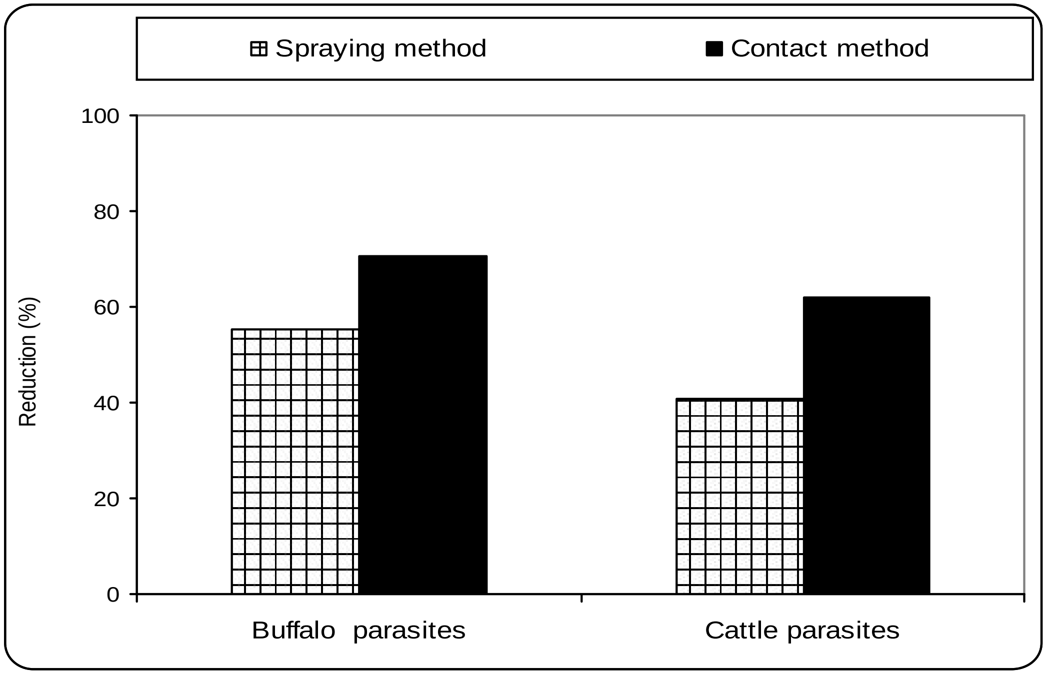
- Fig. (33) Reduction ratios of animal ectoparasites after spraying with Radiant 12% SC (8ml/L) under field conditions, farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.



- Fig. (34) Reduction ratios on animal ectoparasites by using washing and spraying Diazinon 60% EC using 1ml/L under field conditions in farm-animals, Faculty of Agriculture, Assiut University during, 2009-2010.

4.2. Control of mange:

4.2.1. In buffaloes:

- Data in Table (40) showed the control of mange mites infesting buffaloes. Animals were sprayed with Diazinon 60% EC, Butox5%EC, Vertimec1.8%EC at 1ml/L, Radiant 12% SC 6ml/L and Ivermectin 1% (injection). The results showed that, treated animals with Diazinon 60% EC began to respond after 30 days, 35-45days with Vertimec1.8%EC, 25- 30 days by Butox5% EC and after 20-35 days by Ivermectin1% (injection). All buffaloes returned to normal conditions (normal skin) after an average of 45-55 days (Table 40). It might be concluded that spraying with Butox5% EC and Ivermectin 1% (injection) gave a good results in curing buffaloes mange. These results coincided with those obtained by **Abo Elmaged (1998) and Mehlhorn *et al*. (2010).**
- The treated animals with sulfur began to respond after 45-55 days, 20-30days for Ivermectin1% (injection) and sulfur, 25- 30 days for Ivermectin1% (injection) and Butox5% EC spray and 20-35 days for Ivermectin1% (injection) twice a month. All buffaloes returned to normal conditions (normal skin) after an average of 25-40 days, (Table 41).
- In general Butox spray and Ivermectin injection gave a good results in curing buffaloes mange. All animals showed a slight improvement in the clinical picture of the disease by using Ivermectin one time in month, but gave satisfactory results when used fortnightly. It might be concluded that, the subcutaneous injection with Ivermectin eliminates *Sarcoptes scabiei* from buffaloes. The present results on buffaloes agreed with those obtained by **Abo Elmaged (1998).**

- **4.2.2. In sheep:**
- Table (42) showed the results of control mange mites infesting sheep. The spray with Diazinon 60% EC ,Butox5% EC ,Vertimec1.8% EC at 1ml/L, Ivermectin 1% (injection) and Ivermectin with Diazinon 60% EC revealed that the treated animals with Diazinon 60%EC began to respond after 25-30 days, 20-35 for Vertimec1.8% EC, Butox5% EC 20-30 , Ivermectin 1% (injection) 15-30 days and 15-25days for Ivermectin with Diazinon 60% EC. All sheep returned to normal conditions (normal skin) after an average of 30-45. It might be concluded that spraying with Diazinon 60% EC, Butox5% EC and Ivermectin 1% injection gave satisfactory results in curing buffaloes mange. These results coincided with those obtained by **Ibrahim (1994),** when used Diazinon and Ivermectin on infested sheep, he found that the mean time for recovery was 26.4 days in animals treated with Diazinon and 28.4 days in Ivermectin treatments. In general, sheep treated with Ivermectin take less time to recover than in Diazinon treatment. **Cozma *et al*. (2010)** in a study of three acaricides, Doramectin (Dectomax, Pfizer) used at a single dose of 300 µg/kg b.w. given intramuscularly showed a high efficacy (95%) against *Psoroptes ovis*, in naturally infected sheep. All Doramectin treated animals were clinically normal and all skin scrapings were negative for mites 50 days after treatment. At the end of experiment (70 days) only 5% of the animals showed skin lesions and a low infestation score (1+), compared to 10% for Ivermectin.
- Table (43) emphasized the results on sheep with infested sarcoptes and treated with tincture iodine 4%, sulfur with vaseline 10%, Ivermectin 1% (injection) with sulfur and Ivermectin with Butox5% EC. The results showed that the treatment individuals with iodine began to respond after 45-55 days, 35-45days for sulfur, Ivermectin with sulfur 15-25 days and15-25days for Ivermectin with Butox5% EC. It might be concluded that spraying with Butox5% EC and

injection with Ivermectin gave satisfactory results in curing sheep mange, wholly in agreement with **Hagawane *et al*. (2010).**

- In general treated sheep for controlling scabies took less time to recovery than in case of buffaloes scabies. The best results in controlling scabies were obtained when used Ivermectin injection mixed with sulfur or tested pesticide spray on body surface of buffalo and sheep mange. **Ivermectin injection is the best way to control animals mange and using spraying on animals**, Also **Injection can be used only twice a month is better than a one-time** usage (Table 44). The results were obtained by **(Witmer *et al*., 1995)**.

Table (40) Effect of Diazinon 60% EC ,Vertimec 1.8% EC and Butox 5% EC at 1ml/L, Radiant at 6ml/L and Ivermectin1%injection 1ml/50kg on buffalo mange mites under field conditions on farm-animals, Faculty of Agriculture, Assiut University during, 2009- 2010.

Pesticide / Days	Diazinon 60% EC			Vertimec 1.8% EC			Butox 5% EC			Radiant 12% SC			Ivermectin 1% L		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	+	+++	++	+++	++	+	++	+++	++	++	++	+	+++	++	+
3	+	+++	++	+++	++	+	++	+++	++	++	++	+	+++	++	+
5	+	++	++	++	++	+	++	+++	++	++	++	+	++	+	+
7	+	++	++	++	+	+	++	+++	++	++	++	+	+	+	+
10	+	+	+	+	+	+	+	++	+	++	++	+	+	+	+
15	+	+	+	+	+	+	+	+	+	++	++	+	+	+	-
20	+	-	+	+	+	+	-	+	-	+	+	+	-	-	-
30	-	-	-	+	+	-	-	-	-	+	+	+	-	-	-
45	N	-	-	-	-	-	N	N	-	+	+	-	-	N	N

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- +++ = heavily infested animals with scabies
- ++ = moderately infested animals with scabies
- + = slightly infested animals with scabies
- - = no infested and the wool started to grow
- N = normal skin and wool

- Table (41) Effect of using Ivermectin1% 1ml/50kg (injection) with sulfur with vaseline, Ivermectin1% (injection) and Butox 5% EC spray, Ivermectin 1% and Diazinon 60% EC spray and Ivermectin twice on buffalo mange mites under field conditions on farm-animals, Faculty of Agriculture, Assiut University during, 2009- 2010.

treated / Days	Ivermectin 1% and (Sulfur with vaseline)			Sulfur with vaseline 10%			Ivermectin 1% and Butox 5% EC*			Ivermectin 1% and Diazinon 60% EC*			Ivermectin (twice)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	+++	++	+	+++	+++	++	++	+	+++	++	+++	++	+++	++	+++
3	+++	++	+	+++	+++	++	++	+	+++	++	++	++	++	++	++
5	+	+	+	++	+++	++	++	+	++	++	++	++	++	+	++
7	+	+	+	++	++	++	+	+	+	+	+	++	+	+	+
10	-	-	+	+	++	+	+	+	+	+	+	+	+	+	+
15	-	-	-	+	++	+	+	-	+	-	+	+	+	-	-
20	N	-	-	+	++	+	-	-	-	-	-	-	N	-	-
30	N	N	-	+	+	+	N	N	N	N	N	-	N	-	N
45	N	N	N	+	-	-	N	N	N	N	N	N	N	N	N

- *1ml/liter
- +++ = heavily infested animals with scabies
- ++ = moderately infested animals with scabies
- + = slightly infested animals with scabies
- \- = no infested and the wool started to grow
- N = normal skin and wool
-

Table (42)) Effect of Vertemic1.8% EC ,Butox5% EC ,Daizinon60% EC at 1ml/liter ,Ivermectin1% injection 1ml / 50 kg and Radiant 12% SC at 6ml/L on sheep mange under field conditions on farm-animals, Faculty of Agriculture, Assiut University during, 2009- 2010.

-

Pesticide / Days	Vertimec 1.8% EC			Ivermectin 1% L			Butox 5% EC			Diazinon 60% EC			Radiant 12% SC		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	+++	+	++	++	++	+++	++	+++	+	++	+++	+	++	++	+
3	++	+	++	++	++	+	++	++	+	++	+	+	++	++	+
5	++	+	++	+	+	+	+	++	+	++	++	+	++	++	+
7	+	+	+	+	+	+	+	++	+	++	++	+	++	++	+
10	+	+	+	+	+	-	+	+	+	+	+	+	++	++	+
15	+	+	+	-	-	-	+	-	-	+	+	+	++	++	+
20	-	-	-	-	-	N	-	-	-	-	-	-	+	+	+
30	-	-	-	N	-	N	-	-	N	-	-	-	-	-	-
45	N	N	-	N	N	N	N	N	N	N	-	N	-	-	-

+++ = heavily infested animals with scabies

++ = moderately infested animals with scabies

+ = slightly infested animals with scabies

- = no infested and the wool started to grow

N = normal skin and wool

- Table (43)) Effect of Tincture iodine 4% , Sulfur with Vaseline10% , Ivermectin1% and (Sulfur with vaseline) ,Ivermectin and Butox 5% EC and Ivermectin and Diazinon60% EC on sheep mange under field conditions on farm- animals, Faculty of Agriculture, Assiut University during, 2009- 2010.

-

Pesticides / Days	Tincture iodine 4%			Sulfur with vaseline10%			Ivermectin and (Sulfur with vaseline)			Ivermectin and Butox*			Ivermectin and Diazinon*		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	++	+++	+	++	+	+++	+++	++	+	++	+	++	+++	++	+
3	++	+++	+	++	+	+++	+	++	+	++	+	++	+++	++	+
5	++	+++	+	++	+	+++	+	+	+	++	+	+	++	+	+
7	++	++	+	+	+	++	-	-	-	+	-	+	+	+	-
10	++	++	+	+	+	++	-	-	-	-	-	-	+	-	-
15	++	++	+	+	+	+	-	N	-	-	-	N	-	-	-
20	+	+	+	+	+	+	N	N	-	N	N	N	-	-	-
30	+	-	+	+	-	+	N	N	N	N	N	N	-	N	N
45	-	-	-	-	-	-	N	N	N	N	N	N	N	N	N

* 1ml/liter

+++ = heavily infested animals with scabies

++ = moderately infested animals with scabies

+ = slightly infested animals with scabies

- = no infested and the wool started to grow

N = normal skin and wool

- Table (44) Mean time in days for treated buffalo and sheep by some chemicals to recover from scabies during 2009-2010.
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Animals / Treatment	Mean time of recovering (days)	
	Buffalo mange	Sheep mange
Vertimec 1.8% EC at 1ml/L	>45	40-45
Ivermecin 1% (injection) twice	25	-
Ivermecin1% 1 time	45	25-30
Butox 5% EC at 1ml/L	40	30 40
Diazinon 60% EC at 1ml/L	45-50	40 45
Radiant 12% SC at 1ml/L	> 45	45
Tincture iodine 4%	-	>45
Sulfur with Vaseline 10%	>45	>45
Sulfur with Ivermecin	30	15-20
Ivermectin and Diazinon	30	30
Ivermectin and Butox	30	20

4.3. Control of manure ectoparasites:

4.3.1. Mechanical control:

- Data in Table (45) and figure (35) represented the percentage of mortality in sheep-sheds ectoparasites after one to 45 days after applications of cleaning, burning and quicklime methods, caused initial kill of 92.56%, 99.17% and 99.17% with cleaning, burning and quicklime. The activity of the method increased gradually, after so the activity of the method decreased gradually to attain 72.73%, 51.52% and 76.52% after 20 days, respectively. However, after 45 days, the percentages of mortality were reduced to be 54.60%, 18.40% and 53.37% for sheep-sheds parasites, respectively.
- In general, quicklime and cleaning methods showed the highest reduction, followed by burning method. **Mechanical methods** can be used t**o avoid fleas resistance by insecticides in sheep-sheds and the best way is the use of quicklime and extinguished** it **in the soil**. Also **the best of these methods is cleaning or disposal of soil containing fleas and larvae from the sheep farm**, and **these methods are found to be safed without using pesticides.**
- **4.3.2. Chemical control:**
- Data in Table (46) and figure (36) represented the percentage of mortality in sheep-sheds ectoparasites after one to 45 days after applications with Diazinon 60% EC, Vertimec1.8%EC and Butox5%EC spray at 2ml/liter water. Results showed that,the one day post treatment gave an initial kill of 93.43%, 88.35% and 95.45 Diazinon 60% EC, Vertimec1.8% EC and Butox5% EC. The activity of the product increased gradually to attain 99.13%, 100% and 99.57% after 7days respectively, after so, the activity of the product decreased gradually to attain 82.41%, 82.40%

and 88.84% after 20 days, respectively. However after 45 days the percentage of mortality reduced to be 66.67%, 62.24% and 69.58% for sheep-sheds parasites, respectively. **The results showed that, the effect of biocides was slow but still a long time and recommend the using of biocides are for its safe to the environment. The bio-insecticide gave long residual effect** and with using low concentration **(2**%) **in the control of animals ectoparasites**, in agreement with **Kolar *et al*. (2008).**

Table (45) Reduction ratios on animal ectoparasites by using mechanical control on fleas in sheep-sheds under field conditions, farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

Days	**Mean ±SE (%)**		
	Cleaning method	**Burning method**	**Quicklime**
1	92.56 ±1.46 c-e	99.17 ± 0.84 ab	99.17 ± 0.84 ab
3	95.20 ±1.41 cd	98.40 ± 1.63 ab	100.00 ± 0 a
5	99.16 ± 0.86 ab	78.15 ± 2.26 gh	98.32 ± 1.71 ab
7	95.69 ± 3.16 bc	68.11 ± 2.32 hi	94.83 ±1.52 cd
10	86.67 ± 0.85 e-g	63.33 ± 2.25 j-l	90.83 ± 1.70 de
15	80.95 ±1.40 f-h	57.14 ± 1.40 k-m	88.10 ± 1.40 ef
20	72.73 ± 2.67 h-j	51.52 ± 2.04 m	76.52 ± 2.04 hi
25	66.67 ± 0.77 i-k	39.39 ± 3.36 n	67.42 ± 0.77 i-k
30	58.44 ± 1.75 k-m	27.92 ± 2.29 o	62.98 ± 1.14 j-l
45	54.60 ± 1.66 lm	18.40 ± 2.72 p	53.37 ± 2.73 lm
Mean	80.27 b	60.15 c	83.15 a

- Means followed by the same letter are insignificantly different.

Table (46) Reduction ratios on animal ectoparasites by using Diazinon 60% EC, Vertimec1.8% EC , and Butox5% EC using (2cm/liter) on fleas in sheep-sheds under field conditions in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010 .

Days	Mean ±SE (%)		
	Diazinon 60% EC	**Vertimec 1.8% EC**	**Butox 5% EC**
1	93.43 ± 1.86 fg	88.35 ± 1.39 hi	95.45 ± 0.89 r
3	97.03 ± 0.87 de	93.94 ± 0.89 fg	100.00 ± 0 a
5	99.55 ± 0.46 ab	100.00 ±0 a	100.00 ±0 a
7	99.13 ± 0.44 bc	100.00 ±0 a	99.57 ± 0.44 ab
10	90.95 ± 1.52 gh	98.71 ± 0.76 bc	97.84 ± 1.16 cd
15	84.58 ± 1.19 ij	95.49 ± 0.96 ef	93.83 ± 1.19 fg
20	82.41 ± 1.16 jk	82.40 ±0.87 jk	88.84 ± 1.16 hi
25	78.07 ± 1.12 k-m	76.05 ± 0.74 l -n	85.29 ±1.13 ij
30	73.44 ± 1.12 m-o	70.95 ± 0.42 n-p	81.33 ± 0.73 j-l
45	66.67 ± 1.12 pq	62.24 ± 1.12 q	69.58 ± 1.12 op
Mean	86.53 c	86.81 b	91.17 a

- Means followed by the same letter are insignificantly different.

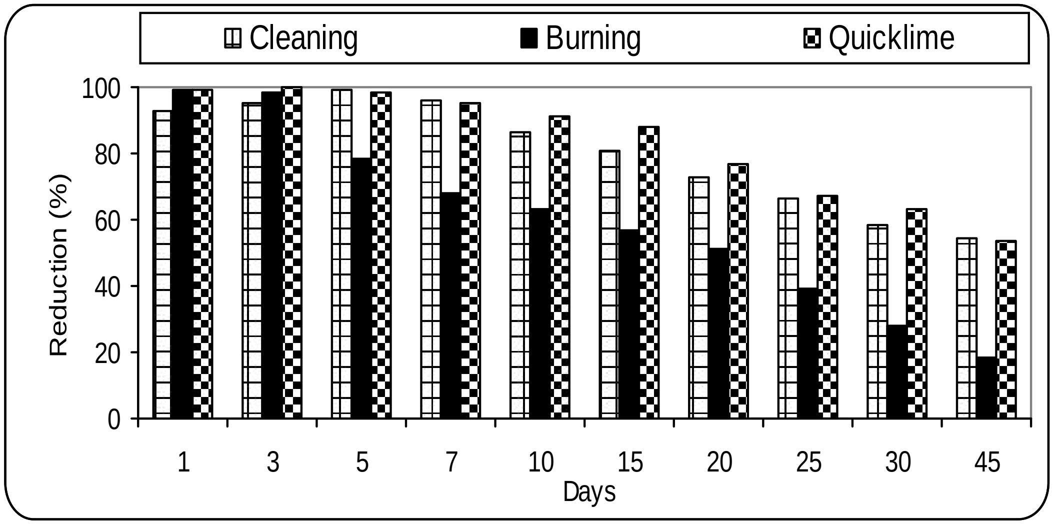

Fig. (35) Reduction ratios on animal ectoparasites by using mechanical control on sheep fleas in sheds under field conditions, in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

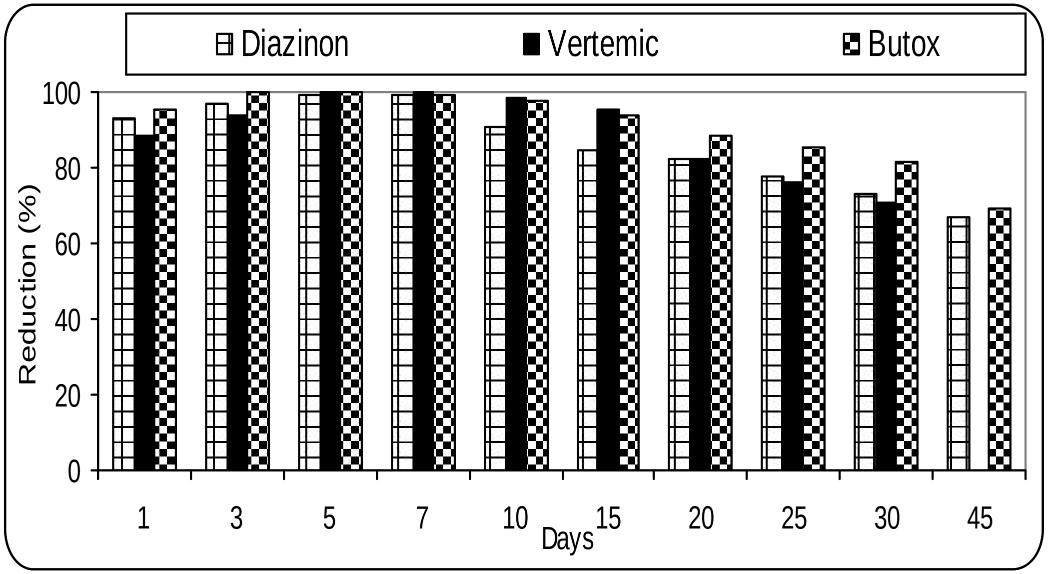

Fig. (36) Reduction ratios on animal ectoparasites by using Diazinon 60% EC, Vertimec 1.8% EC, and Butox 5% EC (2cm/liter) on fleas in sheep-sheds under field conditions, in farm animals, Faculty Agriculture, Assiut University during, 2009-2010.

4.3.3. Fly larvae:

Data in Table (47) and figure (37) represented the percentage of mortality for fly larvae in animal manure after one to 30 days after applications with Diazinon 60% EC, Vertimec 1.8% EC spray at 1cm/liter and Radiant 12% SC at 4cm/liter. Results showed that, the one day post treatment gave an initial kill of 93.85%, 89.28% and 82.14% when treated with Diazinon 60% EC, Vertimec1.8% EC and Radiant12% SC, respectively. The activity of the product increased gradually to attain 100%, 100% and 96.83% after 7 days, respectively. The activity of the product decreased gradually to attain 85.27%, 96.90% and 78.52% after 20 days, respectively. However after 30 days the percentage of mortality reduced to 79.22%, 84.41% and 69.48% for fly larvae in animal-manure, respectively.

The percentages of mortality for fly larvae in animal manure after one to 30 days after applications of Quicklime at dust and Butox 5% EC spray at 1cm/liter were presented (Table 47). Results showed that the one day post treatment gave an initial kill of 93.10% and 89.66% with Butox 5% EC and Quicklime. The activity of the product increased gradually to attain 100% after 7 days when used Butox 5%EC and Quicklime after so, the activity of the product decreased gradually to attain 89.44%n 91.44% after 20 days respectively. However, after 30 days the percentage of mortality reduced to be 83.83% and74.85% for fly larvae in animal- manure, respectively **(Grabovac and Petrić, 2003 and Mehlhorn *et al*., 2010)**

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In general, Vertimec 1.8% EC showed the highest toxicity for fly larvae followed by Diazinon 60% EC and Radiant 12% SC. The Butox 5% SC showed the highest toxicity for fly larvae followed by Quicklime regardless of the rate of application. These results coincided with those obtained by **Abo Elmaged, (1998) he found** that **bio-pesticides have slowly effect on fly larvae, but their use are safe to the environment. Quicklime** c**an also be used to eliminate fly larvae,** this **method is safe and effective.**

Table (47) Reduction ratio of fly larvae by using Diazinon 60% EC, Vertimec1.8 % EC and Butox 5% EC using (1ml/L), Radiant 12% SC using 4ml/L and Quicklime under field conditions in farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

Days	Mean ±SE (%)				
	Diazinon 60% EC	**Vertimec 1.8% EC**	**Radiant 12%SC**	**Butox 5% EC**	**Quicklime**
1	93.85 ± 0.97 cd	89.28 ± 1.57 ef	82.14 ± 0.91 h-k	93.10 ± 0.88 de	89.66± 1.52 ef
3	96.36 ± 0.92 bc	96.36 ± 0.92 bc	86.36± 1.60 e-h	97.52 ± 1.46 bc	97.52± 1.46 bc
5	100.00 ±0 a	100.00 ± 00 a	90.82± 0.93 de	100.00± 0 a	100.00± 0 a
7	100.00 ± 0 a	100.00± 00 a	96.83 ± 1.62 b	100.00 ± 0 a	100.00± 0 a
10	100.00 ± 0 a	100.00 ± 00 a	98.57 ± 1.46 a	98.46± 1.57 ab	98.46 ± 0.78 b
15	87.97 ± 2.03 e-g	100.00 ± 00 a	84.21 ±1.33 g-j	94.96± 1.48 cd	92.44 ± 1.48 de
20	85.27± 2.09 f-i	96.90 ± 00.79 b	78.52± 0.93 k	91.44 ± 1.15 de	89.44 ± 1.24 ef
25	80.88 ± 0.75 i-k	90.44± 1.98 de	71.32 ±1.30 l	90.00 ± 1.18 ef	84.00± 1.18 f-h
30	79.22± 0.66 jk	84.41 ±1.14 f-j	69.48± 1.32 l	83.83 ± 1.06 f-h	74.85 ± 2.11 i-k
Mean	91.51 b	95.27 a	84.25 c	94.37 a	91.82 b

- Means followed by the same letter are insignificantly different

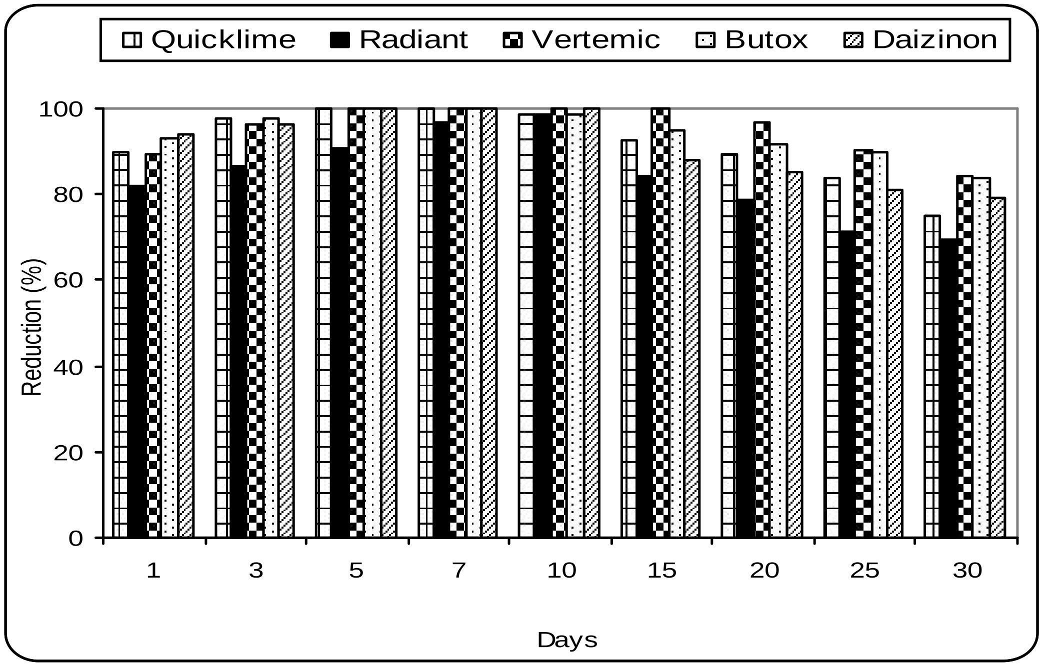

Fig. (37) Reduction ratios on fly larvae treated with Diazinon 60% EC, Vertimec1.8% EC and Butox5% EC (1ml/L), Radiant 12% SC 4ml/L and Quicklime under field conditions, farm animals, Faculty of Agriculture, Assiut University during, 2009-2010.

CHAPTER (4)

STUDIES ON CERTAIN ECTOPARASITES ASSOCIATED WITH SOME FARM ANIMALS AND THEIR CONTROL

- RESULTS AND DISCUSSION

5. Rodent control:

5.1. Under laboratory conditions

5. 2. Under field conditions

- SUMMARY

- REFERENCES

5. Rodent control:

5.1. Under laboratory conditions:

5.1.1. Attractive baits:

Data in Table (48) and Figure (38) illustrated the food consumption of rodent (*R.r.frugivorus*) by using of 4 attractive baits mixed with crush maize (Cumin, coriander, anise, and yeast) as compare with control (crush maize) under laboratory conditions for 5 days. According to the mean consumption during 5 days, it was observed that the mean consumption was high in yeast bait (7.25 gm/rat), coriander (2.35 gm/rat) and anise (2.05 gm/rat) compare with control (0.9 gm/rat). It was found that there was a significant difference in the animal consumption of the four attractive baits tested for *R.r.frugivorus*. Also, there was a significant difference in food consumed by males and females.

In using the *R.r.alexandrinus* it was observed that, the mean consumption of yeast bait was 7.35 gm/rat, and anise (3.63 gm/rat) as compare with control (2gm/rat). It was found that there was a significant difference in the animal consumption of the attractive baits tested for *R.r.alexandrinus*. In addition, there was a significant difference between males and females consumption of the four tested attractive baits.

For the *Arvicanthis niloticus* it was observed that, the consumption was high in yeast bait with crush maize was 4.75 gm/rat, as compared with control (1.83gm/rat). There was a significant difference in the animal consumption of the four tested attractive baits for *Arvicanthis niloticus*, and there was a significant difference in males and females consumption of the four tested attractive baits. Baits preference tests should be done periodically to find out the proper bait for rodenticide formulation and to overcome the shyness of rodent baits (Table 48), the results are in accordance with **Abd El-Rahman *et al.*** **(1991), Shafi *et al.* (1992) and Witmer *et al*. (2008)**.

Generally, the above mentioned results emphasized the significant effect of attractive in bait of rodents. These results may be useful in preparation of rodenticides baits used in rodent control.

5.1.2. Repellent baits:

Data in Table (49) and Figure (39) illustrated the food consumption of rodent (*R.r.frugivorus*) for 4 repellents baits mixed with crush maize (black pepper, jejoba seed, and oshar powder leaf and neem powder leaf) as compared with control (crushed maize) under laboratory conditions for 5 days. According to the mean consumption during 5 days, it was observed that the consumption was low in black pepper bait with crush maize (0.32.5 gm/rat), jejoba seed with crush maize (1.15 gm/rat),while the control was 10.83gm/rat. There was a significant difference in the *R.r.frugivorus* consumption of the four tested repellent baits. Also, there was a significant difference in food consumed by males and females.

In case of the *R.r.alexandrinus* it was observed that, the consumption was low in black pepper bait with crush maize (0.38 gm/rat), and powder leaf oshar with crush maize (0.85 gm/rat) as compared with control (7.05gm/rat). It was found that there was a significant difference in the animal consumption of the repellent baits tested for *R.r.alexandrinus*. Also, there was a significant difference between males and females consumption of the four tested attractive baits.

The consumption was low in black pepper bait (0.83 gm/rat), powder leaf oshar (1.58 gm/rat) as compared with control (7.9gm/rat) *Arvicanthis niloticus* .It was found that there was a significant difference in the animal consumption of the four repellent baits tested for *Arvicanthis niloticus*, and there was a significant difference in males and females consumption of the four tested attractive baits (Table 49).

Generally, the above mentioned results emphasized the significant effect of repellent in bait of rodents. These results may be useful in rodent control. in agreement with **Boeke *et al*. (2004) and Witmer *et al*. (1995)**.

5.1.3. Evaluation of two rodenticides:

Data in Table (50) and figure (40) illustrated the food consumption of rodent (*R.r.frugivorus*) when used two rodenticde baits (Supercaid 0.004% and Caid 0.005%) under laboratory conditions for 5 days. According to the mean consumption during 5 days, in males, the consumption was scarce in Supercaid bait (56.40 gm) as compared with Caid (89 gm), but in females (61.80gm, 78.20gm) were counted for the two rodenticide baits. The dead period for Caid was longer than in the case of Supercaid. It was found that there was a significant difference in the animal consumption of the tested rodenticide baits for *R.r.frugivorus*. Also, insignificant difference in rodenticides consumed by males and females.

In *R.r. alexandrines* male, the consumption was scarce in Supercaid bait (43.40 gm) as compared with Caid (80.40 gm), but in females (34.60gm, 74.80.20gm) were observed. The dead period for Caid was longer than in Supercaid. It was found that there was a significant difference in the animal consumption of the tested rodenticide baits for *R.r. alexandrines*. Also, no significant difference was observed between males and females, the results are as similar as **Abazaid (1990)**, **Littin *et al*. (2000) and Shooba, (2003).**

In *Arvicanthis niloticus*, it was observed that the consumption of males was scarce in Supercaid bait (45.20 gm) as compared with Caid (64 gm), but in females 56.80gm, 60.20gm were recorded. The dead period for Caid was longer than supercaid. It was found that there was a significant difference in the animal consumption of the rodenticide baits tested for *R.r. alexandrines*. Also, a significant difference was found in rodenticides consumed by males and females, in agreement with **Ali (1991), Abazaid (1997), Jackson (2001), Abd El-Galil (2005) and Baghdadi (2006)**.

5. 2. Under field conditions:

5.2.1. Toxicity of rodenticides:

Data in Table (51) studied the two rodenticde bait (Supercaid0.004% and Caid0.005%) under field conditions for 11 days. the population density estimated by trap method. According to the mean of the population, the mean of caught rodents were in Caid (8.18%) higher than in Supercaid (2.18%) as compared with control (11.55%) during the study period. It was found that there was a significant difference in the number of animal catched when used the two rodenticide baits tested, the results agreement with **Maher Ali (1972), Maher Ali and Abdel-Gawad (1982)**, **Saied (1985), Abdel-Gawad (2001b), Ahmaed (2006), Baghdadi (2006) and Valchev *et al*. (2008).**

5.2.2. Acceptability of rodent species to two attractive baits:

Data in Table (52) and Figure (41) summarized the consumption of rodent by Supercaid with two attractive (vanilla and yeast) under field conditions for 6 days. According to the mean consumption (in gm) during 6 days, it was observed that the mean of consumption bait was high in Supercaid with yeast bait (18.17 gm/day) and (11/gm/day) for Supercaid with vanilla compared with control (6.67gm/day). It was found that there was a significant difference in the animal consumption of the rodenticide with attractive baits tested in agreement with **Khan *et al*. (2000).**

5.2.3. Toxicity by aluminum phosphide 33%:

Data in Table (53) and figure (42) studied the Aluminum phosphate fumigation under field conditions for four weeks. The population density estimated by active burrows method. The rodent active burrows were less gradually after so, the activity of the rodent active burrow increased gradually to attain by mean 64.19% after month. Aluminum phosphate can be used in rodent control (**Carl Snider, 1983)**.Aluminum phosphide is a new burrowing rodent fumigant in USA. It reacts with water vapor to produce hydrogen phosphide gas. Hydrogen phosphide is a very toxic gas, however, several characteristics of the product and use pattern give most commercial formulations a low user hazard when used by trained applicators in accordance with label instructions. It is efficacious when used in many situations against several burrowing rodent species, but will not be effective in all situations.

Several factors to consider are burrow temperature, burrow humidity, burrow length and configuration, soil porosity, wind speed and direction, and species specific behavior characteristics. It is particularly desirable to use as a clean-up after a baiting program. Also, it can be used throughout most of the year. The user should read the label carefully to determine all endangered species precautions. Hydrogen phosphide has no secondary hazard although burrow dwelling non-target animals will probably be killed.

In conclusion, the recommended procedure for rodent control is applying aluminum phosphate followed by anticoagulants twice annually seems to be satisfactory to apply within active burrows. However, it is rather important to give all possible attention to environmental sanitation. At the same time, type of applied anticoagulant should be changed upon appearance signs of resistance of rodents under control to such product.**) Witmer *et al*. (1995)**.

Table (48) Mean daily consumption (by gram) of some attractive baits against three rodent species under laboratory conditions.

Rat species	Baits / Sex species	Cumin	Coriander	Anise	Yeast	Control
R. r. frugivorus	♂	0.80c	1.85b	1.95b	7.60a	1.00bc
	♀	1.00c	2.85b	2.10b	6.90a	0.80c
	Total	1.80c	4.70b	4.10b	14.50a	1.80c
R. r. alexandrinus	♂	0.45d	2.75 bc	3.70 b	7.75 a	2.05 c
	♀	0.75 d	2.50 bc	3.55 b	6.95a	1.95 c
	Total	1.20 d	5.25 c	7.25 b	14.70a	4.00 c
A. niloticus	♂	1.05c	1.45c	1.55c	4.70a	2.55b
	♀	0.75c	1.60b	1.65b	4.80a	1.15b
	Total	1.80c	3.05b	3.20b	9.50a	3.65b

- Means followed by the same letter, in the same row, are insignificant different

Table (49) Mean daily consumption (by gram) of some repellents against three rodent species under laboratory conditions

Rat species	Baits / Sex species	Black papper	Jejoba seed	Oshar powder leaf	Neem powder leaf	Control
R.r. frugivorus	♂	0.40c	0.80c	1.10c	2.35b	12.50a
	♀	0.25c	1.50b	1.35b	1.45b	9.15a
	Total	0.65d	2.30c	2.45c	3.80b	21.65a
R. r.alexandrinus	♂	0.60c	1.40c	0.85c	2.35b	6.65a
	♀	0.15d	1.05c	0.85cd	1.95b	7.45a
	Total	0.75d	2.45c	1.70cd	4.30b	14.10a
A. niloticus	♂	1.10c	2.25b	1.85bc	2.30b	8.35a
	♀	0.55c	1.30c	1.30c	2.50b	7.45a
	Total	1.65d	3.55bc	3.15c	4.80b	15.80a

- Means followed by the same letter, in the same row, are insignificant different

. Table (50) Means of daily consumption and dead period of two rodenticides on three rodent species under laboratory conditions

Rat sp.	Species	Males		Females	
		Supercaid 0.004%	Caid 0.005%	Supercaid 0.004%	Caid 0.005%
R.r. frugivorus	Consumption bait	56.40±5.33b	89.00±5.45a	61.80±2.92b	78.20±3.71a
	Dead period	5.60±0.68a	7.20±0.58a	5.00±0.32b	8.20±0.66a
R.r. alexandrinus	Consumption bait	43.40±3.28b	80.40±3.46a	34.60±1.81b	74.80±2.84a
	Dead period	4.80±0.37c	8.00±0.71c	3.80±0.37c	7.40±0.51c
A. niloticus	Consumption bait	45.20±2.48b	64.00±6.49a	56.80±3.43a	60.20±5.20a
	Dead period	4.60±0.40a	6.60±0.51a	3.80±0.37a	7.80±0.58a

- Means followed by the same letter in the same row are insignificantly different

Table (51) Effect of two rodenticides on rodent population under field conditions in farm animals, Faculty of Agriculture, Assiut University, during study period.

Rodenticides / Days post treatment	Supercaid 0.004%	Caid 0.005%	Control
1	2	5	14
2	1	6	8
3	0	9	14
4	0	3	11
5	0	6	9
6	0	8	9
7	1	9	7
8	3	9	13
9	4	10	11
10	6	12	14
11	7	13	17
Total	24	90	127
Mean	2.18±0.76 c	8.18±0.90 b	11.55±0.94 a

Table (52) Daily consumption of Supercaid mixed with attractive baits during 6 days, under field conditions in animal farms, Faculty of Agriculture, Assiut University, during the study period.

Baits / Days	Rodenticide with Attractant baits		
	Supercaid	Supercaid with vanila	Supercaid with yeast
1	4.33±1.20gh	10.67±0.88 ef	20.00±1.16b
2	3.67±1.86h	14.33±2.96c-e	28.00±1.15a
3	3.00±1.53h	11.66±1.45ef	18.00±1.53bc
4	3.33±2.03h	9.00±2.08fg	13.66±1.20c-f
5	3.00±0.58h	11.33±1.33ef	12.33±2.40d-f
6	4.67±2.40gh	9.00±3.06fg	17.00±1.73b-d
Mean	3.67±0.61c	11±0.85b	18.17±1.35a

Table (53**)** Reduction ratios of rodent active burrow after using aluminum phosphate 33% (fumigation) during one month under field conditions in animal-farm, Assiut University.

Reduction (%)			
Number	Area (1)	Area (2)	Area (3)
1	44.44	50	33.33
2	46.67	60	53.33
3	64.29	71.43	71.43
4	78.57	85.71	78.57
5	100	92.31	84.62
6	83.33	75	83.33
7	66.67	41.67	66.67
8	45.45	9.09	54.55
Mean	66.18	60.65	65.73

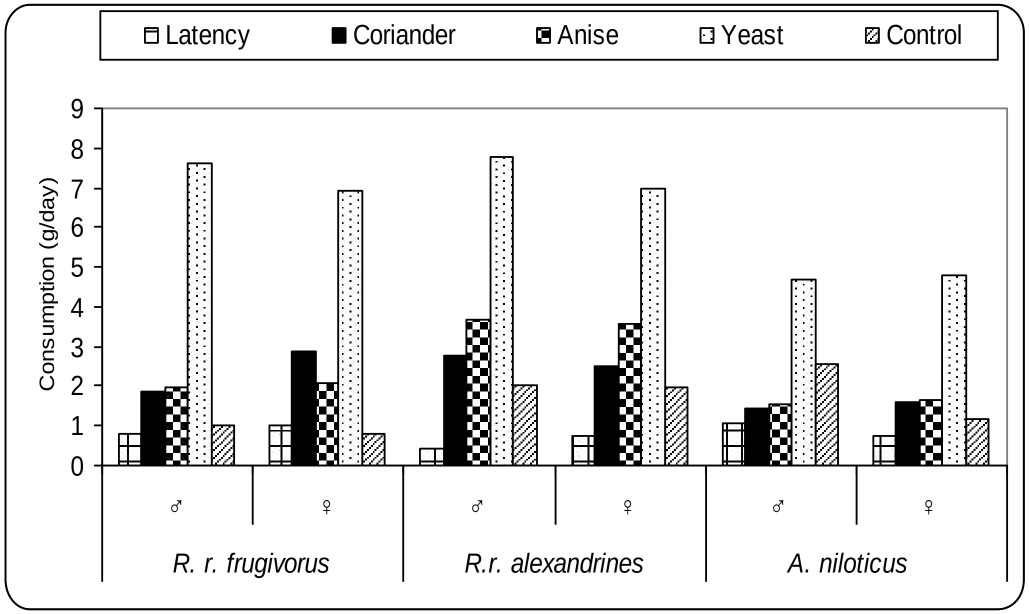

Fig.(38) Mean daily consumption (by gram) of some attractive baits against three rodent species under laboratory conditions.

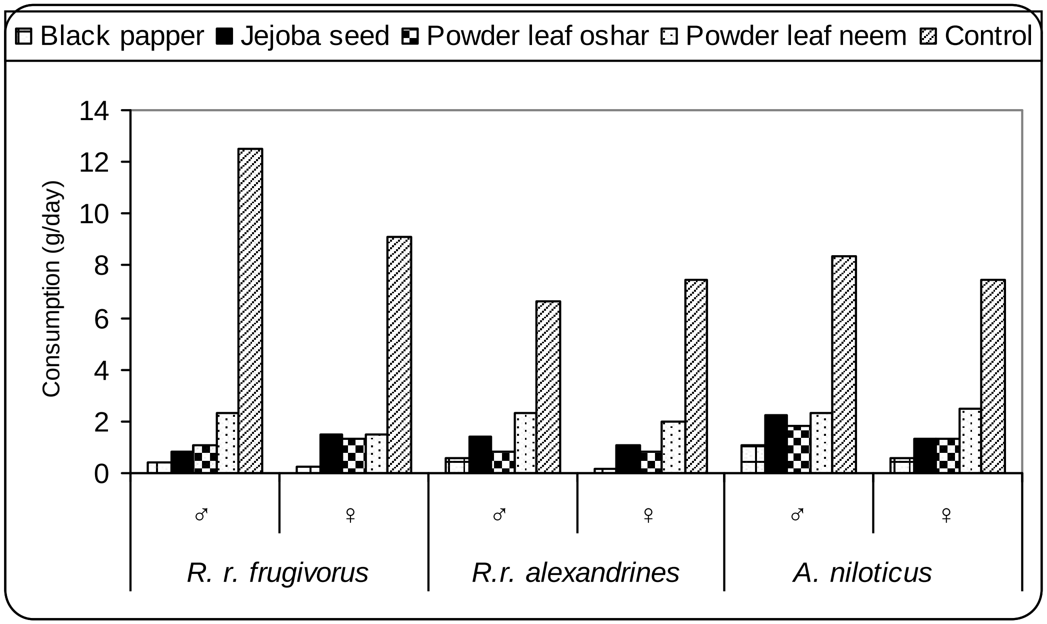

Fig.(39) Mean daily consumption (by gram) of some repellents against three rodents species under laboratory conditions

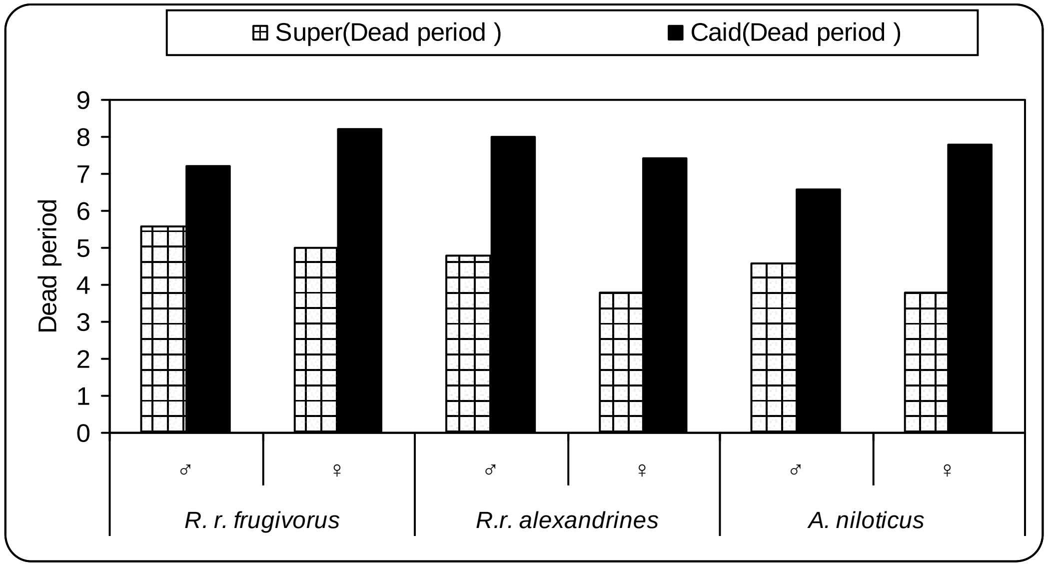

Fig.(40) Means of daily consumption and dead period of two rodenticides on three rodent species under laboratory conditions

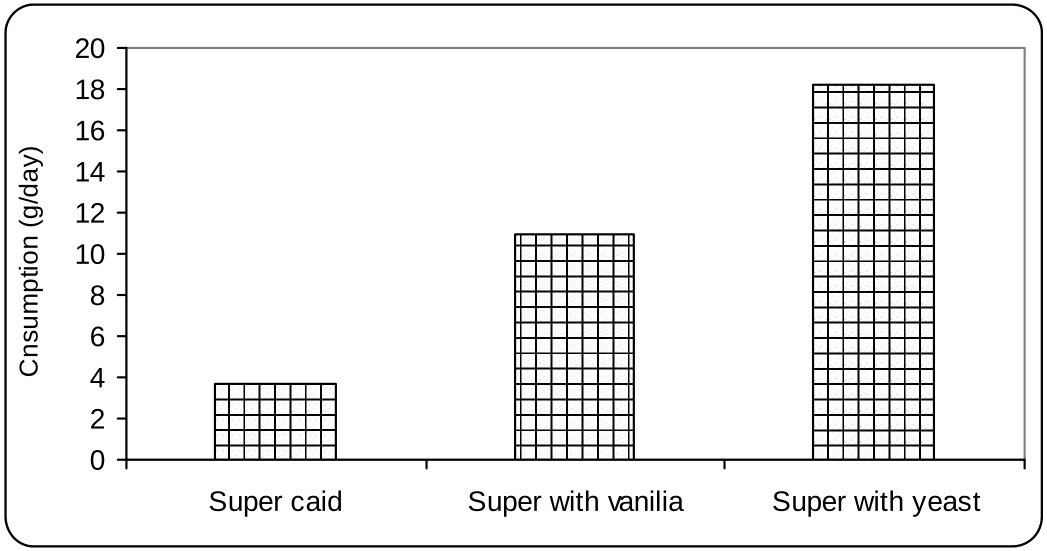

Fig.(41) Daily consumption of Supercaid mixed with attractive baits during 6 days, under field conditions in animal farms of Fac. Agric., Assiut University.

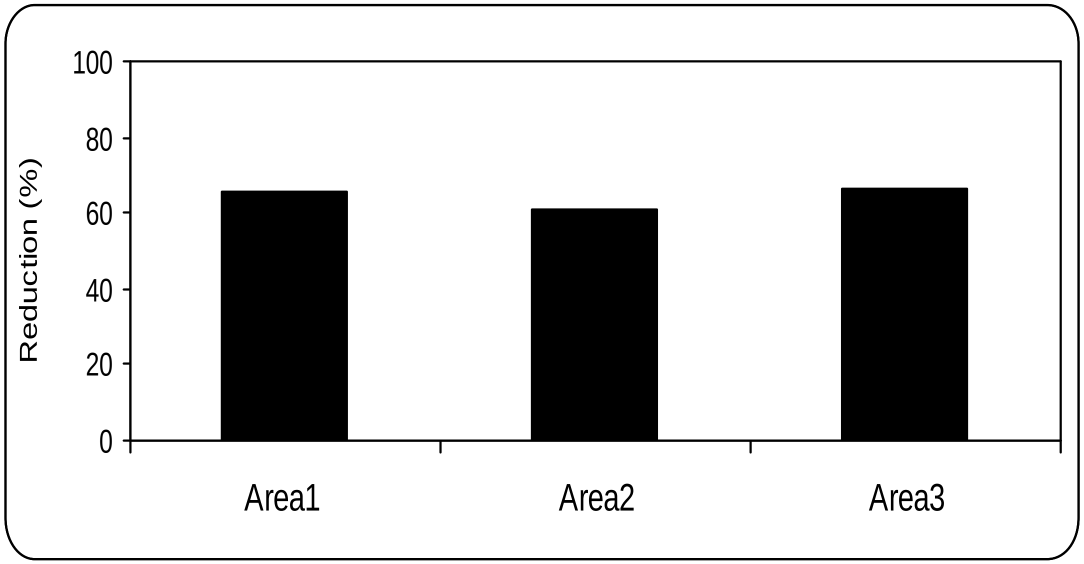

Fig. (42) Reduction ratios of rodent active burrows after using aluminum phosphate 33% (fumigation) during one month under field conditions in animal-farm, of Fac. Agric., Assiut University.

SUMMARY

The economic impact from changes in livestock and the need for increased parasite surveillance and control have been increased the need for a better understanding of the current distribution on domestic animal ectoprasites. The success in the using effective pesticides and some resent trends for controlling as main step in ectoparasites eradication .Ectoparasites controlling program depends on identifying the species of the parasites under local environmental conditions. The parasites arthropods infesting farm animals have not gained much attention in upper Egypt. So, that the present study aims to study the following topics.

- Survey the farm animal pests in addition to the farm animal ectoparasites.
- Survey the rodent species and their ectoparasites.
- Determining of population density of ectoparasites on their body surface and in the soil of the animal husbandry.
- Control the ectoparasites on the animal body and in the sheds.
- Control rodent in the animal husbandry using various methods.

1- General survey of pests inhabiting farm animals in the area of study:

1.1. Rodents:

Rodents trapped from animal-farm, Assiut University during the period from 2007 to 2010 years. Recorded species were: the white bellied rat, *Rattus rattus frugivorus* (Linnaeus) represented by 52.86%, the grey-bellied rat, *Rattus rattus alexandrinus* (Linnaeus), 28.74% and the Nile grass rat, *Arvicanthis niloticu*s (Desmarest), (18.40%).

1.2. Flies and mosquitoes:

Adult stages of fly and mesquite species, found in animal production farm during 2008 - 2010 at Assiut University, were: *Musca domestica* Macq, *Muscina canicularis* Wied, *Stomoxys calcitrans* L, *Tabania* sp. Merg, *Sarcophaga* sp. L and *Phormia regina* F.In addition to a single of mosquitoes, *Culex* sp.

2. Survey of ectoparasites:

2.1. On animal body surfaces:

The animal body surfaces were suffered with infestation of certain pests (i.e., lice on buffaloes, fleas on sheep and ticks on cattle body surfaces.

2.2. In manure of animals:

In soil of husbandry animals, the recorded ectoparasites were: *Amblyomma* sp., *Haemophysalis* sp., *Pullex irritans and Xenopsyllae cheopis* from cattle-sheds and *Sarcoptes* sp., the oriental flea *Xenopsyllae cheopis* and *Sarcoptes* sp., from sheep-sheds. Four species of mites were: *Amerosieus* sp., *Hypoaspis smithii, Glycyphagus* sp., and *Tarsonemus* sp., one species of hard tick, *Haemaphysalis* sp., a single species of fleas, *Xenopsylla cheopis* and a single species of lice, *polyplax spinulosa* were educed from rodent burrows.

2.3. On rodent species body surface:

Eight species of mites (*Amerosieus* sp., *Hypoaspis smithii, Ornithonyssus bacoti, Rhizoglyphus echinopus, Glycyphagus* sp., *Myocoptes* sp., *Tarsonemus* sp. and *Cheyletus zaheri*): two species of hard ticks, *Amblyomma* sp. and *Haemaphysalis* sp.; three species of fleas *Xenopsylla cheopis, Leptopsylla segnis, Pulex irritans* and two species of lice, *Polyplax spinulosa, Haplopleura oenonydis* were also collected from the body surface of certain rodent species.

3. Population density of ectoparasites:

3.1. Ectoparasite on animals:

The population density of ectoparasit species occurred on animal bodies were studied of during the period 2008/2009. The dominant lice species infested buffaloes represented by 96.23% of the total number of buffalo ectoparasites, ticks on cattle by 97.31% and fleas on sheep by 78.47% of the parasites population .The highest density of ectoparasites in buffalo was recorded in spring (50.66%), and the lowest one was occurred in winter (3.39%). On cattle body surface, the highest density of ectoparasites was observed in spring (66.37%), the lowest population was recorded during winter representing by 2.69%. In sheep-farm, the highest density was observed in winter (67.83%) and the lowest was recorded during summer (5.19%). In 2009/2010, the lice were the dominant ectoparasites on buffaloes representing by 95.80% while ticks were the dominant ectoparsites on cattle representing by 94.81% and fleas on sheep represented by 94.32%.

The highest density of ectoparasites in buffalo-farm was observed in spring (58.12%), the lowest population was recorded during winter (4.12%), whereas on cattle high population was recorded during spring (60.99%) and the lowest population was recorded in winter (5.19%), whereas on sheep winter harbored high density (76.56%), in contrary summer exhibited only (1.68%) of ectoparasites.

Significant correlation coefficients between minimum and mean diurnal temperatures versus lice densities on buffaloes were 0.48* and 0.59*. (0.36* and 0.26*) were recorded between both temperatures versus ticks population on cattle. The effect of maximum and minimum relative humidity was also recorded (0.60*and 0.64*) on sheep fleas, significant correlation were obsereved during 2008/2009. In 2009/2010, r=0.48*was recorded between diurnal temp., of the density of lice on buffaloes, significant negative correlation (-0.71**and -0.69*) were found between max., and min., R.H. and the ticks population on cattle, (0.70and 0.65*) were recorded between max., and min., R.H. and fleas population sheep the study clearly indicated the temperature and relative humidity were determining factors in all husbandry animals ectoparasites and may explain the seasonal dynamics of these pests as well as the inhibition off- season.

3.2. Ectoparasites collected from animal manure:

The population of ectoparasite species in the animal soil during 2008/2009 showed that, ticks dominant species of parasites in cattle-sheds represented by 61.54% , while in sheep-sheds the fleas represented by 98.44% of the parasites population .In rodent active burrows, the mites were represented by 92.09%. High density of ectoparasites in cattle farm was observed in spring 42.31%, scarce in autumn. In sheep-sheds 74.98 % of ectoparasites were collected in winter. The lowest population was recorded during summer 3.54%. In rodent burrows the highest population was observed during spring 35.60 %, the lowest on was recorded during summer 13.63%. In 2009/2010, the highest population of ticks in cattle-sheds was 70.27% of the total parasites population. While in sheep-sheds, the fleas represented by 98.11% of the total parasites population and 89.97% in rodent active burrows.

The highest density of ectoparasites in cattle-sheds was observed in autumn (35.14%), the lowest was recorded during winter (14.41%). In sheep-sheds, the highest population was observed in winter (64.79%), the lowest one was recorded during summer (6.48 %). In rodent burrows, the highest population was observed in autumn (35.45%), the lowest population was recorded during summer (17.39 %).

The maximum and minimum relative humidity were significant positive correlations (0.65*and 0.65*) were recorded between max, and min., R.H. versus animal manure ectoparasites, significant negative correlations were recorded (-0.68*and -0.62*) between max., and min., R.H. versus fleas in rodent burrows.

3.3. **Ectoparasites on rodents:**

3.3.1- Ectoparasites collected from *Rattus r. frugivorus* body surface:

In 2007-2009, the study of rodent ectoparasites density showed that the high density of ectoparasites on *Rattus r. frugivorus* was observed in autumn (34.08%) followed by spring (27.99%) and summer (22.31%). The lowest population was recorded during winter (15.62%).

Males rodent were found to be harbored the highest density of ectoparasites in March and the lowest was in January. In female rodents, the highest density was recorded in October and the lowest was noticed in January. In 2009- 2010, high density of ectoparasites was observed in autumn (34.99%) followed by spring (30.20%) and winter (22.91%). The lowest population was recorded during summer (11.90%).

Males rodent were found to be harbored the highest density of ectoparasites in February and the lowest density in August, while in females rodents, the highest density of ectoparasites was recorded in October and the lowest was noticed in June. The comparative study between males and females showed that, there was an increase in the rate of infestation by females than males.

Significant correlation coefficients (0.43* and 0.59**) were noticed between the maximum and minimum of relative humidity versus mites on males. Also significant positive correlation were recorded between mites on females and the maximum temperature, the maximum and minimum relative humidity r= (0.034*, 0.46* and 0.42*) during the first year, respectively. The same results were obtained during the second year of study.

3.3.2. Ectoparasites collected from *Rattus r. alexandrines* body surface:

High density of ectoparasites was recorded during spring season followed by summer and autumn representing by 40.96%, 27.39% and 22.07%, respectively. The lowest density was observed during winter 9.58%. Male rodents were harbored the highest density of ectoparasites in June while the lowest density was in September, 2007-2009.

In the second year, high density of ectoparasites was recorded during spring season 45.63% followed by winter and summer representing by8.13% and 10.63% respectively. The lowest density was observed during winter representing 8.13%. Males rodent were harbuored the highest density of ectoparasites in April and October, the lowest one occurred in January. In females of rodent, the highest density was found in females of both rodent species.

Positive correlations were noticed between maximum temperature, minimum temperature, mean diurnal temperature and mean night temperature versus mites on rodent males (0.41*, 0.39*, 0.47*and 0.49*) respectively.

3.3.3. Ectoparasites collected from *Arvicanthis niloticus* body surface:

The highest density of ectoparasites was recorded during summer and spring (31.37%, 29.81%). The lowest density was observed during winter by 11.49%. Males rodent were found to be harbored the highest density of ectoparasites in April, November and the lowest one in February, while in females rodent the highest density was found in both rodent species in June and July and the lowest one in January of 2009/2010.

Significant positive correlations were recorded between the maximum temperature, minimum temperature, mean diurnal temperature and mean night temperature versus mites on rodent males (0.45*, 0.39*, 0.44*and 0.48*) respectively, and (0.51**, 0.61**, 0.56**and 0.58**) on rodent females respectively.

4. Control studies:

4.1. Control of ectoparasites in animal:

4.1.1. Ectoparasites on the animal body surface regions:

Lice eggs were counted high numbers in animal front region,lice adult in medium region, nymph in back region. The population density of ticks on cattle in back region was higher than from front region.

4.1.2. In animals:

The mean of mortality percentages of lice on buffaloes, tick on cattle and fleas on sheep were recorded after 45 days from treatment with Diazinon 15% EC spray at 1ml/liter water 32.13%, 26.16% and 12.43%, respectively. However, by using Diazinon 60% EC spray at 1ml/liter these percentages were 57.06%, 37.22% and 46.01%, for lice on buffaloes, tick on cattle and fleas on sheep. The percentages of reduction after 45 days from treatment when used Vertiemec 1.8% EC spray at 1ml/liter water were 56.03%,58.21% and 48.33% to lice on buffaloes, tick on cattle and fleas on sheep, but by using Butox 5% EC spray at 1ml/liter water these were 66.53%, 62.02% and 62.26%, respectively. The percentages of reduction after 45 days from treatment by using Ivermectin1%, 1m/50kg injection were 74.45%, 69.53% and 41.05% for the same animals of parasites, respectively.

The mean mortality percentage to lice on buffaloes, tick on cattle, fleas on sheep after 45 days from treatment with Diazinon 60 % EC spray at 1.5 and 2ml/liter water, were recorded (59.19 and 59.11%,) and (72.71 and71.40) respectively, also (68.71% and 64.26%,) ,(83.26 and 76.49) with Vertimec 1.8% EC spray at 1.5 and 2ml/liter water, and (71.22% and 68.36%,), (84.40 and 80.25) with Butox5% EC spray at 1.5 and 2ml/liter water.

The mean mortality percentages to fleas on sheep after 30 days from treatment with Butox 5% EC spray at 1ml/liter water on sheep with and without wool were recorded (90.48 and 66.17%).

The mean mortality percentage to lice on buffaloes, fleas on sheep were (39.99 and 13.46%), (59.72 and 34.91%) and (73.14 and56.12%) after 30 days from treatment with Radiant 12% SC spray at 4,6and 8 ml/liter water, respectively. But the percentage of reduction for tick on cattle was (33.23, 48.94 and 62.10 %,) after 30 days from treatment with Radiant 12% SC spray 6, 8 and12 ml/liter water, respectively.

The mean mortality percentage to lice on buffaloes and ticks on cattle were 55.38 and 70.43% on lice and 40.63 and 62.03%, on ticks after 30 days from treatment with Diazinon 60% EC spraying and contact method at 1ml/liter water.

4.2. Control of sarcoptic mange:

4.2.1. In buffaloes:

The results show that the treated individuals with sulfur began to respond after 45-55 days, 20-30days for Ivermectin 1% 1ml/50kg (injection) with sulfur, Ivermectin with Butox5% EC, 25- 30 days and Ivermectin 20-35. The spraying with Butox 5% EC and Ivermectin 1% injection gave satisfactory results in curing buffaloes mange.

In general, all husbandry animals showed a slight improvement in the clinical picture of the disease by using Ivermectin one time a month, but gave satisfactory results when used at two time month (20- 30). It might be concluded that the subcutaneous injection with Ivermectin eliminates *Sarcoptes scabiei* from buffaloes after 20-30 days.

4.2.2. In sheep:

Sarcoptes were sprayed with Diazinon 60% EC, Butox 5% EC and, Vertemic 1.8% EC spray at 1 ml/L water, Ivermectin 1% 1 ml/50kg (injection) and Ivermectin with Diazinon 60% EC, the results show that the treated individuals with Diazinon 60% EC began to respond after 25-30 days, 20-35 for Vertemic 1.8% EC, Butox5% EC 20-30 , and Ivermectin 15-30 days and Ivermectin with Diazinon 60% EC 15-25 days all sheep returned to normal conditions (normal skin) after an average of 30-45. The spraying with Diazinon 60% EC, Butox 5% EC and Ivermectin injection gave satisfactory results in curing sheep mange.

The results show that the treated individuals with tincture iodine 4% began to respond after 45-55 days; 35-45 days for sulfur with vaseline 10%, Ivermectin with sulfur 15-25 days and Ivermectin with Butox 5% EC 15-25, the spraying with Butox 5% EC and Ivermectin injection gave good results in curing buffalo mange. It might be concluded that Ivermectin with sulfur or Butox 5% EC are effective in controlling mange mites in husbandry animals. Morever, **Injection treatment twice a month is better than a one-time use**.

4.3. Control of manure ectoparasites:

4.3.1. Mechanical control:

The mean mortality percentage to fleas on sheep in soil were recorded 80.27, 60.15 and 83.15%, after 45 days from treatment with mechanical methods, Cleaning, Burning, and Quicklime methods, respectively.

4.3.2. Chemical control:

The mean mortality percentage to fleas on sheep in soil were recorded (86.53, 86.81 and 91.17%), after 45 days from treatment with Diazinon 60% EC, Vertimec 1.8% EC, and Butox 5% EC spray at 2 ml/liter water, respectively.

4.3.3. Fly larvae:

The mean of mortality percentage to fly larvae in animal manure, were recorded (91.51 and 95.27%, 84.25, 94.37 and 91.82), after 30 days from treatment with Diazinon 60% EC, Vertimec 1.8% EC and Butox 5% EC (1ml/liter), Radiant 12% SC (4ml/L) and quicklime, respectively.

The animal farm satisfactory, ventilation with periodical removal of animal manure and the renewal with the straw substrates, and the use of safer on the husbandry soil are recommended in order to control the immature stages of certain animal-ectoparasites such as flies and ticks.

5. Rodent control

5.1. Under laboratory conditions

5.1.1. Attractive baits:

The mean consumption of attractive baits was recorded. Yeast with crush maize (7.25 gm/rat) and coriander (2.35 gm/rat) are the most effective baits as compare with control treatment of (crush maize) only (0.9 gm/rat), for *R.r.frugivorus*. But in *R.r.alexandrinus*, it was observed that the mean consumption was high in yeast bait with crush maize (7.35 gm/rat), and anise (3.63 gm) as compare with control (2gm/rat).In *Arvicanthis niloticus* the mean consumption was high in yeast bait

(4.75 gm) as compared with the control bait (1.83gm/rat). Baits preference tests should be done periodically to find out the proper bait for rodenticide formulation and to overcome the shyness of rodent baits.

5.1.2. Repellent baits:

The food consumption was less in black pepper bait with crush maize (0.32.5 gm/rat), jejoba seed (1.15 gm) as compared with control one (10.83gm/rat) for *R.r.frugivorus*. In *R.r.alexandrinus* was observed that the consumption was less in black pepper bait (0.38 gm/rat), and oshar powder leaf (0.85 gm/rat) as compared with control (7.05gm/rat). *A. niloticus* consumed scarce amount of black pepper bait (0.83 gm/rat) and powder leaf oshar (1.58 gm/rat) as compared with control (7.9gm/rat) .Generally; these results may be satisfied in rodent control.

5.1.3. Evaluation of two rodenticides:

It was observed that the forced feeding of rodent males on Supercaid bait was (56.40 gm) as comparison with Caid (89 gm), but in females the numbers were: (61.80gm, 78.20gm) in the feeding on Supercaid and Caid tell death.

In *R.r. alexandrines*, the males consumed less in Supercaid bait (43.40 gm) as comparison with Caid (80.40 gm),while the revere was observer in case females (34.60 gm, 74.80. gm), the same results were obtained when used *A. niloticus*.

3. <u>2. Under field conditions</u>

5.2.1. Toxicity of rodenticides:

Data show the mean of caught rodent individuals in field with baits satiations. Caid 0.005% was (8.18%) as compared by Supercaid 0.004% (2.18%). It was found that there was a significant difference between the caught animals of the tested rodenticide baits.

5.2.2. Acceptability of rodent species to two attractive baits:

Data showed a significant difference in the animal consumptions of the rodenticide with different tested attractive baits. The consumption of attractive baits was 18.17 gm/day yeast with Supercaid as compared to vanilia with Supercaid, 11 gm/day.

5.2.3. Toxicity by aluminum phosphide 33%:

The active burrows of rodent were decreased when used Aluminum phosphate fumigation (64.19%) after one month as compared to the normal burrows.

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