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LIFE PARAMETERS OF *Glycyphagus domesticus* (De Geer) (ACARINA: GLYCYPHAGIDAE) INFESTING STORED APPLES – RESULTS OF LABORATORY CULTURE ON BEE-BREAD

ABSTRACT. House mite, *Glycyphagus domesticus* (De Geer) belongs to synanthropic species and pests infesting various stored products including fruits (e.g. fresh apples, dried plums), bee products and other food-stuffs.

Biological investigations of this species were conducted under controlled laboratory conditions (±20°C, 85% RH) using bee-bread as mite food. Some of the most important results obtained are as follows: complete development – 24.4 days, eclosion of imagines – 74.5%, longevity of adults – 55.7 days, oviposition period – 36.9 days, fecundity – 190.4 eggs per female life-span. These data give evidence that the biological potential of *G. domesticus* is relatively high and bee-bread seems to be an attractive and effective medium ensuring its complete development and favourable population increase.

House mites (all stages) often occur on decaying and mouldy products and feed on mycelia of fungi infesting them. In this connection they may play an important part in transmission of diseases and spreading of pathogenic and saprophagous microorganisms causing damage and putrefaction of infested fruits and other food products.

Key words: *Acarina*, acaroids, apples, biology, *Glycyphagus domesticus*, house mite, life parameters, stored fruits, stored products

INTRODUCTION. Majority of glycyphagids (*Glycyphagidae*) are cosmopolitan, commonly known as synanthropic mite species. Of them, house mites, *Glycyphagus domesticus* (De Geer) belong to the commonest pests of various food (e.g. grain products, seeds, dried fruits, vegetables, mushrooms, medicinal herbs, spices). They occur in dwelling- and store-houses, apiaries, barns and other farm buildings. They are also inhabitants of nests of birds, rodents and social insects, e.g. honey bee. References give some faunistic, anatomical and bio-ecological information concerning *G. domesticus* (Barker, 1986; Boczek, 1980; Boczek and Gołębiowska, 1959; Brady, 1970; Chmielewski, 1971abc, 1978, 1987, 1988; Chmielewski and Gołębiowska, 1971; Cusack et al., 1975; Fain et al., 1988; Gołębiowska and Nawrot, 1976; Hora, 1934; Hughes, 1976; Hughes and Hughes, 1939; Kadzhaja, 1970; Oboussier, 1939; Rack, 1988; Sinha, 1968; Tseng and Chang, 1973; Tűrk and Tűrk, 1957; Zakhvatkin, 1941; Zhdarkova, 1967).

Results of some Polish acarofaunistic studies show that they are also very common invaders of beehives and fruit stores (Chmielewski, 1990, 1992, 1998ab). Acarological analyses of stored apples proved the presence of over 22 mite species colonizing them. *G. domesticus* was a dominant stored product pest, found in 77.3% of examined samples. Adult house mites and all juvenile instars, including hypopodes (spore-like survival nymphs) of the species were observed often in large numbers.

Some references present data concerning the occurrence, feeding and development of these mites on mouldy products and mycelia of seed born fungi infesting them (Sinha, 1964; Sinha et al., 1969).

There are some reports that *G. domesticus* is also a pest of sanitary importance producing strong allergens causing bronchial asthma and dermatitis (“grocer’s itch”) and may be even an intermediate host and disseminator of tapeworms (*Catenotaenia pusilla* (Goeze), (Baker and Wharton, 1952; Fain et al., 1988; Hughes, 1976; Joyeux and Baer, 1945). Some of the author’s own observations conducted on mouldy products and stored apples (unpublished data) showed that house mites could eat fungi infesting these products and were their

transmitters. This is consistent with some information of other authors that various microorganisms (fungi, bacteria) are attractive diets for these acaroids (Sinha, 1966; Sinha and Harasymek, 1974). So there is a suspicion that house mites might be vectors of fungal and bacterial diseases causing putrefaction of stored fruits or mould of hive products and bee provisions (e.g. bee-bread in honey-combs).

The aim of this experiment was to test the suitability of bee-bread for laboratory culture of *G. domesticus* and production of acarological material for studies on the transmission of fungal spores and other microorganisms causing damage, decay and mould of apples and other stored products and a significant deterioration of their storage condition.

MATERIAL AND METHODS. Post-harvest sweepings (hay, straw) from barn and winter beehive debris were a source of living specimens o*f G. domesticus*, which were used for the initiation of laboratory stock cultures of this species. Monocultures and experiments were conducted at room temperature (±20°C) and monitored relative humidity (±85%); bee-bread collected from cells of honey-combs served as mite food. Observations of mite development were started from 200 one-day-old eggs (20 rearing cages x 10 eggs) and were continued until the eclosion of imagines. Newly obtained (one-day-old) males and females were paired and each pair was placed separately in a cage on a portion of food (bee-bread). Oviposition and longevity of 25 mite pairs were examined from their eclosion till natural death of the last specimen. The method used herein was very near to that described in an earlier publication presenting similar studies on the same species but using other kinds of mite food, i.e. bee collected pollen (pollen loads) (Chmielewski, 1995).

RESULTS AND DISCUSSION. Biological experiments conducted in the laboratory made possible to collect enough data for calculation of some life parameters of the species. Confrontation of the present results with biological data obtained in the similar studies upon the house mite fed two other media, i.e. pollen loads and mixture of wheat

germ + baker's yeast in a proportion of about 1:1 (Chmielewski, 1988, 1995), is shown in Table 1.

Table 1. Bionomics of *Glycyphagus domesticus* (De Geer) on various media under laboratory conditions (±20 °C, 85% RH)

Life parameter	Medium		
	bee-bread (present study)	pollen loads (Chmielewski, 1995)	germ + yeast (Chmielewski, 1988)
Embryonic development [days]	6.6 (3-10)	6.3 (3-14)	5.1 (4-11)
Hatched larvae [%]	92.5 (50-100)	88.7	72.0
Life history [days]	24.4 (18-32)	22.1 (13-44)	21.2 (17-24)
Hypopus formation [%]	9.0 (0-50)		
Eclosion of adults [%]	74.5 (40-100)	64.7 (18-79)	79.3
Frequency of females [%]	50.4 (20-80)	44.9 (20-62)	62.5
Longevity of imagines [days]	55.7 (36-85)	46.9 (8-138)	25.0 (11-125)
Oviposition period [days]	36.9 (9-73)	25.1 (1-96)	27.5 (6-54)
Preoviposition period [days]	3.2 (2-5)	4.2 (2-17)	4.7 (3-26)
Interval within oviposition period [days]	1.2 (0-28)	2.9 (0-26)	
Postoviposition period [days]	15.8 (1-48)	17.2 (0-63)	11.0 (1-31)
Total female fecundity [eggs]	190.4 (25-382)	63.5 (1-189)	58.2 (6-125)
Productivity of female per life-day [eggs]	3.4 (0-12)	1.3 (0-14)	1.1
Productivity of female per oviposition-day [eggs]	5.2 (1-12)	2.9 (1-14)	2.1 (1-8)

Comparison of the presented results shows that some parameters slightly vary, but differences between others are more pronounced, according to the kind of food. As shown, complete development of mites on bee-bread (mean 24.4 days) was longer than on pollen loads or composition of wheat germ plus baker's yeast (22.1 and 21.2 days, respectively). Oviposition period (36.9 days) and fecundity, i.e. egg production per female life-span (190.4 eggs), were higher on bee-bread

than on two other diets. Average longevity of adult specimens on bee-bread (55.7 days) prevailed over the same parameter obtained on the two remaining media, i.e. pollen (46.9 days) and wheat plus yeast (25.0 days) (Fig. 1 and 2).

Figure 1. *Glycyphagus domesticus* (De Geer) – some imagines and juvenile instars (stereoscopic microscope – photo W. Chmielewski)

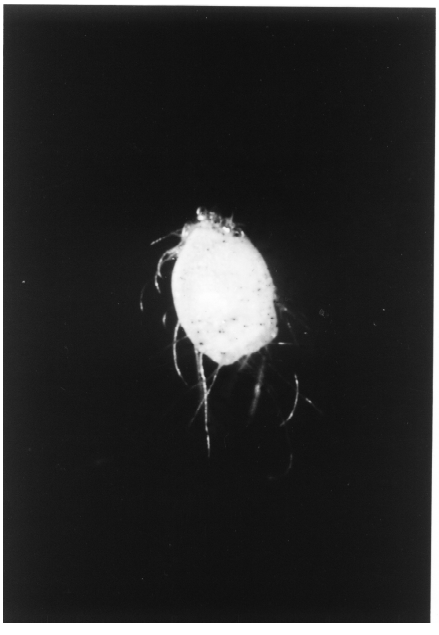

Figure 2. *Glycyphagus domesticus* (De Geer) – hypopus stage (stereoscopic microscope – photo W. Chmielewski)

House mite produces the encysted heteromorphic deutonymphs, so called hypopus stages, which are of immobile type. Hypopodes (or hypopi) were observed sometimes in ontogenetic experiments (about 9% of protonymphs transformed into hypopial specimens), but in stock cultures they appeared more often and usually in large numbers, almost such as in nature, where this phenomenon is sometimes of mass character. These spore-like forms, together with imagines and other developmental stages (eggs, larvae, protonymphs and homeomorphic deutonymphs) of the species, were observed very often in dried herbs, fruits (prunes) and fresh apples deposited in storehouses.

House mites mainly infest fruits stored under primitive conditions. They occupy various parts of apples, but first of all the calyx and peduncle hollows, peduncles, pieces of spurs and leaves, cavities and damages caused by insects and diseases as well as mechanical injuries and scars of fruit cuticle. They form colonies usually together with other species representing various groups of mites, mainly acaroids (e.g. *Lepidoglyphus destructor* (Schrank), *Michaelopus corticalis* (Michael), *Tyrophagus longior* (Gervais)); they are often accompanied also with predatory species (*Cheyletus eruditus* (Schrank), *Melichares tarsalis* (Berlese)), which are natural enemies of stored product pests (Chmielewski, 1990,1998a).

CONCLUSIONS

1. *G. domesticus* is a mite species well adapted to bee-bread as a natural nourishment securing its normal development and population increase.
2. This kind of food can be recommended as an attractive and effective medium for laboratory rearing of mites and for the production of biological material for experimental and educational purposes (demonstrations for beekeepers, fruit-farmers, school children, university students etc.).
3. Author's own observations of the feeding behaviour of house mites colonizing mouldy beehive products (bee-bread, pollen, hive debris) and decaying stored apples, together with the relevant data from literature concerning relationships between mites, fungi and bacteria, give well-founded reasons for suspicions that these pests are carriers of pathogenic and saprophagous microorganisms, harmful for stored fruits and other food-stuffs.
4. Results of the experiments and observations suggest the need for undertaking the study on the importance of stored-product mites in spreading microorganisms (fungi, bacteria) in storehouses and the relation between acaroid species and pathogens causing damage to stored fruits.

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