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ALLOMETRIC VARIATION IN *RHIZOGL YPHUS ROBINI* CLAPAREDE (ACARI: ASTIGMATA: ACARIDAE)

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ABSTRACT

The bulb mite, *Rhizoglyphus robini* Claparede (Astigmata: Acaridae) was reared on three diets of decreasing nutritive value. Males which had developed on the best food were largest, while those on the poorest food, smallest. Measurements of body, leg I, setae sc *e* and setae *sc i* showed that length of the former three varied in the same ratio from diet to diet. Setae *sc* i, however, were much longer on the larger mites, much shorter on the smaller ones. This pair of setae, whose relative length is of importance in the systematics of *Rhizoglyphus*, thus evinces allometric variation. Scanning electron microscopy showed that the penis of *R. robini* is covered by two genital valves which part to allow the penis to emerge.

INTRODUCTION

Some mites of the genus *Rhizoglyphus* (Astigmata: Acaridae) are common soil dwellers which may damage bulb crops in the field (Manson, 1972). Although the genus itself is well defined (Hughes, 1976; Manson, 1972), authors have differed in their interpretation of its best-known species, *Rhizoglyphus echinopus* (Fumouze et Robin). One school (Eyndhoven 1968,1972; Fain, 1977; Manson, 1972) argues that *R. echinopus* carries long internal scapular *(sc i*) setae and the male has a rounded penis base. The other school (Hughes, 1976) holds that *echinopus* actually lacks *sc i* setae, and that its penis has an oval base (calling the species with long *sc i* setae *R. callae* Oudemans). All authors agree that mites with short, almost minute *sc i* setae and a conical penis base are best accommodated under the name *R. robini* Claparede.

While conducting life history studies on *R. robini* (Gerson, Capua and Thorens, in press) it was observed that mites reared on different diets differed in body size. The present essay explores the possibility that length of *sc i* setae of this mite is a variable nutrient-dependent character. Scanning electron microscope (SEM) micrographs of the penis are also presented, to further an understanding of its structure.

METHODS

A single female of *R. robini* was picked at random from a population kept on peanut seeds and placed for 24 hours in an individual plexiglass cage (Gerson *et al.*, in press). The thirty-odd eggs deposited were separated into three batches and each placed on a different diet in Petri dishes. Diets assayed were: (a) Water-soaked peanut seeds (variety Virginia); (b) Tap-water extract of such seeds; (c) Filter paper (Whatman No. 1) only, wetted with tap water. (Former studies (Gerson *et al.*, l.c.) have shown that *R. robini* may develop on this starvation diet). Dishes, sealed with parafilm strips (to prevent mite escape or entry), were opened once a week for wetting and resealed. All cultures were kept in the laboratory (18-25°C and total darkness) for five months. Large populations developed on peanut seeds and on their water extract, but only a very small one on filter paper. At least ten males were taken from each population, mounted in Hoyer's medium and examined. The body (from tip of chelicerae to end of opisthosoma) and leg I (tip of tarsus to base of femur) of each specimen were then measured, along with the external scapular (*sc e*) and *sc i* setae. Leg and setal measurements from the two sides of each body were averaged.

Males reared on peanuts were glued onto stubs, coated with palladium and scanned with a JEOL SEM (model JSM-35C) at 25 KV.

RESULTS AND DISCUSSION

The various diets had a marked and significant effect on all parameters measured (Table 1), while variation remained uniformly low (except in regard to setae *sc i*). The effect, however, was uneven: lengths of body, leg I and even setae *sc e* decreased by about the same ratio from peanut seeds to peanut extract and from there to filter paper (Table 2), but the ratio for *sc i* was different. This deviation is even more marked upon comparing the length ratios between mites reared on peanut seeds and filter paper (1.7-1.9 for the first three parameters, 2.9 for setae *sc i*). Upon comparing these measurements with each other as affected by the various diets (Table 3), it becomes evident that setae *sc i* were relatively shorter on mites with the smallest bodies, longest on the largest (almost by a factor of two). Allometric variation was also obtained in relation to setae *sc i* and leg I as well as setae *sc e*, the pair closest to *sc i* (Fig. 1). Length ratios of other parameters were not affected by the various diets.

TABLE 1. THE EFFECT OF THREE DIETS ON LENGTH (in um) OF BODY, LEG I, SETAE *SC E* AND SETAE *SC I* OF MALES OF *RHIZOGLYPHUS ROBINI*

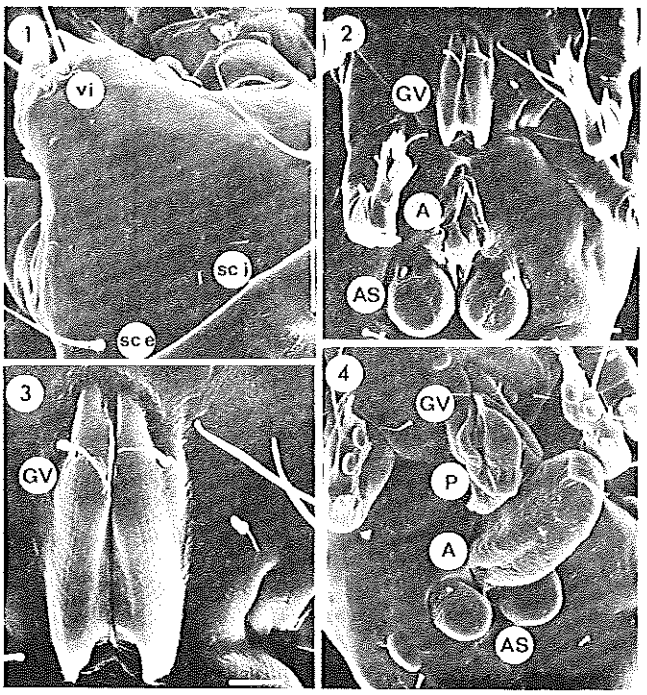
CV denotes coefficient of variation (CV = S.D./x), expressed in percentages. Different letters following means signify differences, $P < 0.01$, using Duncan's multiple range test.

Diets	Body		Leg I		Setae *sc e*		Setae *sc i*	
	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Peanuts	643.2a	8.7	196.6a	10.9	146.3a	10.6	7.2a	14.3
Peanut extract	468.7b	8.6	147.9b	11.1	106.1b	13.8	4.1b	26.2
Filter paper	377.1c	7.7	117.5c	10.1	75.5c	11.9	2.5c	19.2

TABLE 2. RATIOS BETWEEN LENGTHS OF BODY AND SOME ORGANS MEASURED FROM MALES OF *RHIZOGLYPHUS ROBINI* FED ON VARIOUS DIETS

Diets	Peanuts/ Peanut extract	Peanut extract/ filter paper	Peanuts/ Filter paper
Ratios			
Body/body	1.4	1.2	1.7
Leg I /leg I	1.3	1.3	1.7
sc e/sc e	1.4	1.4	1.9
sc i/sc i	1.8	1.6	2.9

Size variation in males of *R. robini* was noted by Hughes (1976), who stated that they may measure 450-720 µm. Size is known to be a major cause of allometric growth, which brings about allometric variation (Mayr, 1969). Czajkowska (1972) offered many medicinal plants to *R. echinopus* and reported that there were almost three-fold differences in mite size between those reared on unsuitable herbs and those on the control diet. It is thus reasonable to postulate the occurrence of similar variations in



Figs. 1-4. Micrographs of males of *Rhizoglyphus robini*: 1. Dorsum of propodosoma, showing location of setae *sc e, sc i* and, in order to define propodosoma, setae *vi* (right-hand bar denotes 100 µm). 2. Venter of hysterosoma, showing closed genital valves (GV), anus (A) and anal suckers (AS) (lower right-hand bar denotes 10 µm). 3. Closed genital valves, enlarged (lower right-hand bar denotes 10 µm). 4. Venter of hysterosoma. Genital valves open and penis (P) partly extruded. Anus with excretion (faint left-hand bar denotes 100 um).

the length of setae *sc i* in *R. echinopus* also. Such variation should be considered while using this character in the definition of *Rhizoglyphus* spp.

SEM microscopy showed the male's genital valves of *R. robini* to differ from those described by Eyndhoven (1968, Fig. 1, 1972, Fig. 5), Hughes (1976, Fig. 133a) and Manson (1972, Fig. 26). The valves are elongated, with lower conical supporting struts and clearly bilobed (Figs. 2, 3), not entire as shown in the above-listed figures. Hughes, 1976, in her Fig. 136, also showed the genital valves to consist of two parts. The valves open posteriorly to extrude the penis (Fig. 4). At mating the male extends its penis backward, directly into the female's bursa copulatrix (they copulate end-to-end, with the male's opisthosoma being placed above that of the female). The penis shown in Fig. 4 was probably either in the process of being extended or of being withdrawn.

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TABLE 3. RATIOS BETWEEN LENGTH OF BODY AND DIFFERENT ORGANS OF MALES OF *RHIZOGLYPHUS ROBINI* FROM THE SAME DIETS

Diets	Peanuts	Peanut extract	Filter paper
Ratios			
Body/leg I	3.3	3.2	3.2
Body/*sc e*	4.4	4.4	5.0
Body/*sc i*	89.3	114.3	150.8
Leg I/*sc e*	1.3	1.4	1.6
Leg I/*sc i*	27.3	36.1	47.0
sc e/*sc i*	20.3	25.9	30.2

REFERENCES

Czajkowska, B. 1972. Influence of active substances of medicinal herbs on stored products mites. *Zeszyty Problemowe Postepow Nauk Rolniczych* 129:197-232.

Eyndhoven, G.L., van. 1968. *Rhizoglyphus engeli* nov. spec., with notes on the genus *Rhizoglyphus* (Acari, Acaridae). *Beaufortia* 15 (193):95-103.

Eindhoven, G.L. van. 1972. Some notes on the genitalia of the genus *Rhizoglyphus* (Acari, Acaridae). *Zeszyty Problemowe Postepow Nauk Rolniczych* 129:23-26.

Fain, A. 1977. Charactères comparés des hypopes de *Rhizoglyphus echinopus* Fum. et Robin et de *Sancassania chelone* Oudemans (Astigmates: Acaridae). *Acarologia* 19:105-111.

Gerson, U., S. Capua and D. Thorens. Life history and life tables of *Rhizoglyphus robini* Claparède (Acari: Astigmata: Acaridae). *Acarologia*, in press.

Hughes, A.M. 1976. The Mites of Stored Food and Houses. Her Majesty's Stationary Office (2nd edition) 400 pp.

Manson, D.C.M. 1972. A contribution to the study of the genus *Rhizoglyphus* Claparède, 1869 (Acarina: Acaridae). *Acarologia* 13:621-650.

Mayr, E. 1969. Principles of Systematic Zoology. Mc Graw Hill, 428 pp.