Relationship between *Megastigmus suspectus* Borr. Size and *Abies alba* Mill. Seed Size

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Investigation on the relationship between the size of the *Megastigmus suspectus* Borr. (Hymenoptera, Torymidae) and the size of *Abies alba* Mill. seed from which those insects emerged was conducted. The examined insects (n = 46) originated from southern Poland, and were obtained from cones collected in 1993. *M. suspectus* thorax length was used as an index of adult insect size, because that was correlated with 8 other body measurements. In addition, the diameter of the emergence hole of this insect was measured. All data were log-transformed and analysed using regression analysis. There was no linear correlation between adult size and seed size, using either length of thorax or any of the other 8 body traits tested.

Keywords *Megastigmus suspectus*, body size, seed, *Abies alba*.
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1 Introduction

Megastigmus suspectus is one of the most frequently reported insect pests of fir *(Abies alba)* seeds. The larva of this species develops in the seed, first eating its entire contents and then pupating there. The adult emerges through a circular hole made in the seed coat.

Although the information about this insect has been reported by many authors, e.g. Kapuściński (1966), Skrzypczyńska (1978), Schwenke (1982), Roques (1983) and Křistek and Skrzypczyńska (1992), there are still many gaps including morphometric studies of *M. suspectus* and studies of the relationship between host size and adult insect size.

The objectives of this study were:

- to determine the relationship between the thorax length of *M. suspectus* (as a criterion for body size), and the length and diameter of the emergence hole,
- to examine relationships between the thorax length of *M. suspectus* and selected body parts.

2 Materials and Methods

The material studied consisted of 380 fir seeds and adults of *M. suspectus* (n = 46) reared from these seeds. The seeds were randomly selected from samples obtained from cones of *Abies alba*. The cones were collected in September 1993 from 8 fir trees growing in the Sucha Forest Management Unit near Babia Góra National Park. The Park is on the UNESCO list of world biosphere reserves.

Single seeds were placed in glass test-tubes plugged with cotton wool (individual rearings). During the late autumn and winter they were kept under shelter, but in conditions close to the natural ones. In the mid-February of the next year they were transferred to the laboratory. The emergence of *M. suspectus* was checked twice a week till the beginning of May 1994 when adults stopped emerging.

The rearing yielded only females of *M. suspectus*, as male rare in this species. The females and the seeds from which they emerged were used for morphometric measurements. A stereomicroscope (Technival 2 Carl Zeiss, Jena) and a 10x the eyepiece with PZO scale were used. As in case of *Megastigmus aculeatus nigroflavus* Hoffm. (Nalepa and Grissell 1993), the measurements included length and width of stigma, length and width of first flagellomere, ocellocular distance, and maximum diameter of laternal ocellus. Length of the seed and diameter of the emergence hole were also measured. Length of the thorax was used as a criterion for body size and as the reference measurement for the measurements for body parts mentioned above. The head and abdomen were not measured because of possible distortions and inconsistent positioning. The length of the ovipositor was not measured because it is curved. Length of the thorax was measured from the front edge of the pronotum to the hind edge of the propodeum.

The morphological data for 46 females of *M. suspectus* were log-transformed and treated to regression analysis.

Seeds from which no *M. suspectus* emerged (334 seeds in total) were cut and classified to one of the following categories: viable, empty (nonviable), inhabited by *M. suspectus* larvae or adults which did not emerge from the seeds, damage by *Resseliella piceae* Seitn. (Diptera, Cecidomyiidae).

3 Results

There was no linear dependence between the length of the thorax and the length of the seed (Fig. 1), nor between the length of the thorax and the diameter of the emergence hole (Table 1). The length of seeds measured varied from 8.2 to 12.8 mm. Taking into account the size of the seed on one hand, and the number of emerged adults (n = 46) on the other, the highest number of individuals, 11, emerged from seeds 10 mm long. This was followed by seeds 10.8 mm long with 6 individuals emerged, and seeds 11.4 mm long with 5 individuals. Single insects emerged from seeds of smallest length, 8.2 mm, as from seeds of largest length, 12.8 mm (Fig. 2).

The analysis dissections of 334 seeds from which no insects emerged showed that 47 seeds (12.4 %) contained larvae of *M. suspectus*, 38 were inhabited by adults of *M. suspectus* that did not emerge, and 166 were damaged by *Resseliella piceae*. There were only 9 viable and 74 empty seeds damaged by this insect amounted to 131; or 34.5 % of the total number of seeds analysed.

The statistical analysis showed no correlation between most of the measurements. In other words, there is no correlation between the length of the thorax and the length of the measured body parts. Only in case of relationship between length of the thorax and length of scape and flagellomere one could perceive a correlation (Table 1).

Table 1. Relationship between *M. suspectus* thorax length and length of host seeds, diameter of chalcid exit hole, and size of other chalcid body parts.

Measured character	Equation	r^2	F	P
Length of stigma	log y = –1.30 – 0.34log x	0.0050	2.2794	0.1384
Width of stigma	log y = –2.63 + 0.10log x	0.0093	0.4058	0.5275
Length of flagellomere	log y = –2.36 + 0.78log x	0.1878	9.9403	0.0030
Width of flagellomere	log y = –2.81 + 0.29log x	0.0298	1.3206	0.2568
Diameter lateral ocellus	log y = –2.56 + 0.17log x	0.0201	0.8840	0.3524
Ocelocular distance	log y = –1.96 + 0.26log x	0.0574	2.6184	0.1129
Length of scape	log y = –1.47 + 0.39log x	0.1912	10.1675	0.0027
Length of pedicel	log y = –2.54 + 0.44log x	0.0722	3.3474	0.0743
Length of seed	log y = +2.18 + 0.25log x	0.0317	1.4088	0.2418
Diameter exit hole	log y = –0.38 + 0.39log x	0.0441	1.9815	0.1664

4 Discussion

The study demonstrated no correlation between the size of individuals of *M. suspectus* and the

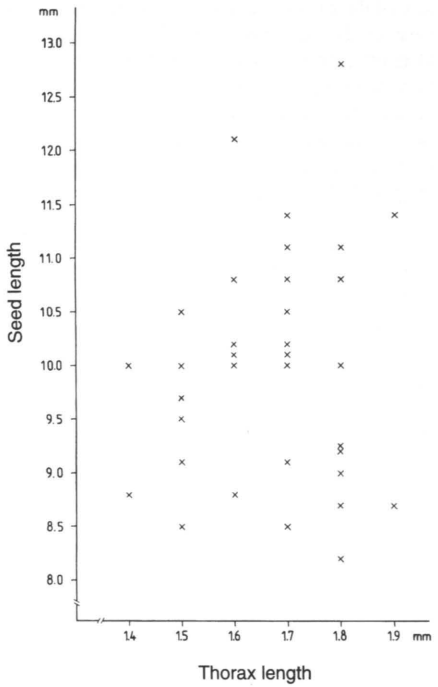

Fig. 1. Relationship between thorax length of *Megastigmus suspectus* and size of seeds from which they emerged (n = 46).

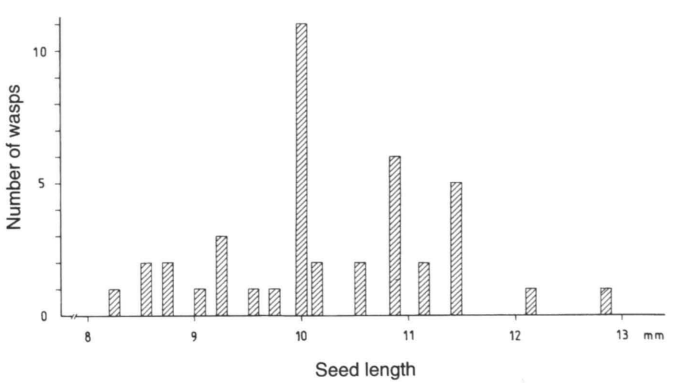

Fig. 2. Relationship between size of seed of *Abies alba* and number of adults of *Megastigmus suspectus*.

size of the fir seeds from which they emerged. In case of *M. suspectus nigroflavus*, Nalepa and Grissell (1993) found a significant correlation between host size and adult insect size. These authors also reported that 6 of 9 measured characters increased isometrically with length of the thorax. In case of *M. suspectus*, two characters – length of the scape and the length of the first flagellomere – were closely correlated with length of the thorax.

Almost 10 % of the analysed seeds contained adults of *M. suspectus* which did not emerge. Perhaps the relative humidity in the laboratory, which was lower than natural conditions, was the cause of this lack of emergence.

It is notable that a high percentage of seeds were damaged by *M. suspectus* and *R. piceae*, as compared with the percentage of viable seeds. According to Schimitschek (1935) up to 63 % of fir seeds were inhabited by *M. suspectus*. This study confirms that seed pests may have a significant negative influence on natural regeneration of fir.

Acknowledgement

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