except for the scape and pedicel, which are black; tibiae yellow, hind tibia with a black basal stripe; fore wing (only 0.750 mm) distinctly shorter than body, and scape (0.145 mm) shorter, although otherwise the body is bigger. *C. anthracinus* COMPERE 1925, from South Africa, differs in having more numerous sensillae and a shorter stigmal nerve.

The terminology is according to RICHARDS (1956). The drawings were made from parts of the body mounted in Euparal; negatives taken with an automatic camera microscope (Panphot, E. Leitz) were projected with an ordinary photograph magnifier.

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References: FERRIÈRE, CH. 1965. Hymenoptera Aphelinidae d'Europe et du Bassin Méditerranéen. Faune de l'Europe et du Bassin Méditerranéen 1. Paris 206 pp. — MERCET, R. G. 1932. Notas sobre Afelinidos (Hym. Chalc.) 5ª nota. Eos, Rev. Esp. Ent. 8, p. 5 – 9. — NIKOLSKAYA, M. N. 1963. The chalcid fauna of the U.S.S.R. (Chalcidoidea). Jerusalem 593 pp. (Translated from Russian by Dr. A. BIRRON and Z. S. COLE, the original work: NIKOLSKAJA, M. N. 1952. Chalcidii Fauni SSSR. Acad. Sci. U.S.S.R. Moskva-Leningrad. 575 pp.). — RICHARDS, O. W. 1956. Hymenoptera. Introduction and keys to families. Handbooks for the identification of British insects 7, p. 1 – 94.

On the hibernation sites of Myrrha octodecimguttata L. (Col., Coccinellidae) on the butts of the pine (Pinus silvestris L.).

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Introduction.

The hibernation and aggregation of different coccinellid species have been studied by a number of investigators (see the reviews by HODEK 1960, HAGEN 1962). However, there are only some scattered notes on the hibernation sites of *Myrrha octodecimguttata* L. (see SALMELA 1938, PULLIAINEN 1963, 1964).

The collection of material for the orientation and flying activity of *Myrrha octodecimguttata* (see PULLIAINEN 1964) provided an opportunity to make systematic observations on the hibernation sites of the species on the butts of pines (*Pinus silvestris* L.).

The purpose of this paper is to provide records of these studies.

Material and methods.

The observations here presented were made in a rather dry pine peat-bog situated in the western part (Haaga) of the city of Helsinki. *Myrrha 18-guttata* was known to hibernate in the crevices of the bark on the butts of these pines (PULLIAINEN 1963). The mean height of the pines ($D_{1.3}$ = on average 13 cm) was about 5 m and their mean age correspondingly 60—70 years. Pines for this study were chosen at random. The marked pines were barked from ground level to a height of about 0.5 m. The ground level could easily be determined in the study conditions in question. For the sake of control some of the pines were barked to the thin-barked part of the trees. The barking was performed with the help of sheath-knives by removing the thick bark under which *M. 18-guttata* specimens were hibernating.

Specimens which were at most 2 mm distant from each other were regarded as an aggregation (cf. also GREENSLADE 1963). All the aggregations found were investigated, until the total number of lone specimens and aggregations studied was 100. The total number of pines studied was about 40. The number of specimens in each aggregation, the height of the lone specimens and aggregations above the ground and the point of the compass of each specimen and aggregation on the pines were recorded.

These studies were performed in the period 17.—22. III. 1964. At this time the beetles were still in their hibernation quarters. The total number of specimens recorded was 302.

Results.

Myrrha 18-guttata finds its way to its hibernation quarters mainly in September.

On the butts of pines the hibernation sites of *M. 18-guttata* are situated in crevices in the bark. The hibernating specimens in a crevice had almost without

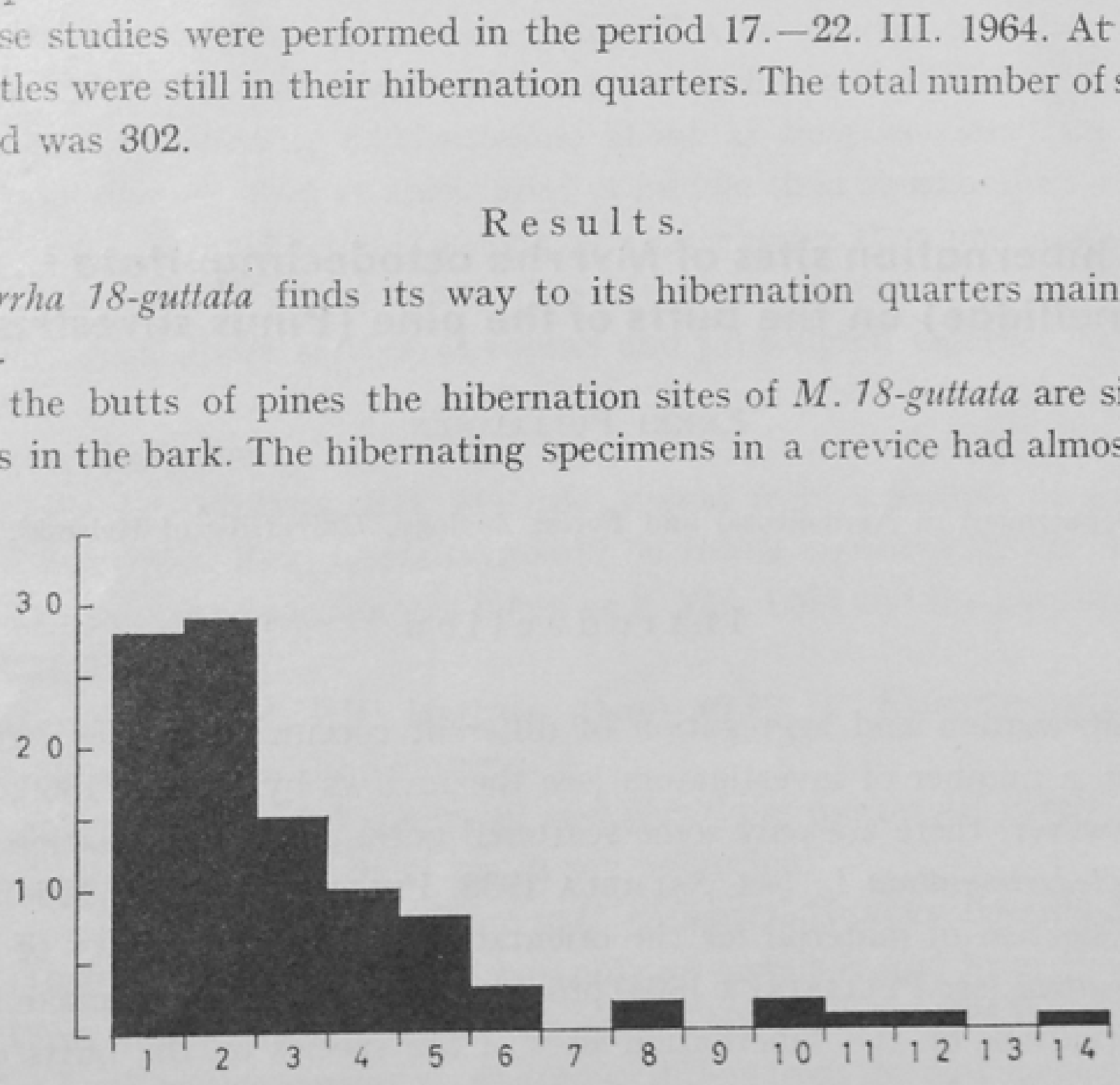

Fig. 1. The distribution of the lone specimens and aggregations of *M. 18-guttata* in the different size classes. Ordinate: number of lone specimens and aggregations. Abscissa: size class.

exception aggregated as a group. In Fig. 1 the distribution of the lone specimens and aggregations in different size classes is shown. In 28 % of the cases the specimens were alone in the crevices and in 72 % they had aggregated as groups. The mean size of the aggregations (2 or more specimens) was 3.8. Correspondingly, the greatest aggregation consisted of 14 specimens.

In Fig. 2 the distribution of the aggregations and lone specimens of the species in the vertical direction is shown. It can be seen that 94 % of the aggregations and lone specimens were at a height of 0—10 cm. However, it is to be noted that only one aggregation (5 specimens) was at ground level, whereas in the zone of the following 2 cm there were 14 per cent of the total number of aggregations and lone specimens. Only one aggregation was found at the height of 21 cm. The mean size of the aggregations and lone specimens (Fig. 1, A) was almost the same throughout the height scale.

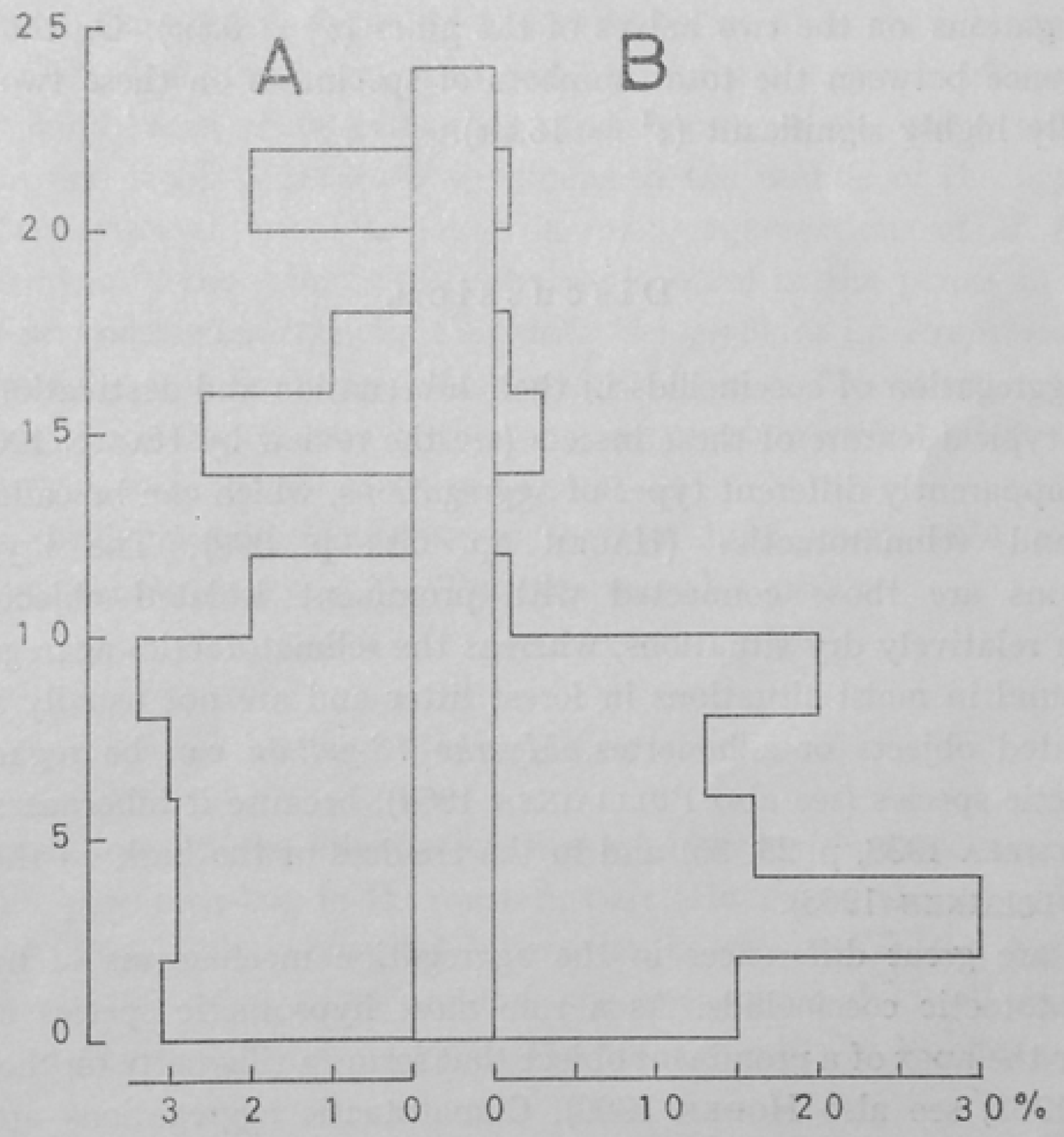

Fig. 2. (A) The mean sizes of the lone specimens and aggregations of *M. 18-guttata* in the different height zones on the butts of pines. (B) The relative vertical distribution of the lone specimens and aggregations of *M. 18-guttata* on the butts of pines. Ordinate: height of the butts above ground level in centimetres. Abscissae: (A) mean sizes. (B) lone specimens and aggregations as percentages of the total number of cases studied.

Owing to the great technical difficulties involved, the points of the compass are presented only to the accuracy of the four main points of the compass. The values NE, SE, SW and NW have been divided between the corresponding cardinal points. The results are shown in the following tabulation.

	The main points of the compass			
	N	E	S	W
No. of lone specimens and aggregations	20	24	30	26
Total no. of specimens	55	92	94	61

We can take the working hypothesis that *M. 18-guttata* is more abundant on the east and south sides of the pines, which are warmed by the sunshine, than on the other sides of the trees. For this purpose the values for the east and south and correspondingly those for the west and north are combined. The chi square analysis shows that there is no difference in the distribution of the lone specimens and aggregations on the two halves of the pines ($\chi^2 = 0.640$). On the contrary, the difference between the total numbers of specimens on these two halves is statistically highly significant ($\chi^2 = 16.226$).

Discussion.

The aggregation of coccinellids in their hibernation and aestivation quarters is a very typical feature of these insects (see the review by HAGEN 1962). There are two apparently different types of aggregations, which can be called »hypsotactic» and »climatotactic» (HAGEN op. cit., p. 309). The »hypsotactic» aggregations are those connected with prominent isolated objects usually present in relatively dry situations, whereas the »climatotactic» aggregations are mostly found in moist situations in forest litter and are not usually associated with isolated objects or silhouettes. *Myrrha 18-guttata* can be regarded as a climatotactic species (see also PULLIAINEN 1964), because it hibernates in forest litter (SALMELA 1938, p. 25, 35) and in the crevices of the bark on the butts of pines (PULLIAINEN 1963).

There are great differences in the aggregation mechanisms of hypsotactic and climatotactic coccinellids. As a rule most hypsotactic species congregate on or near the apex of a prominent object that forms a silhouette on their horizon (HAGEN 1962; see also HODEK 1960). Climatotactic aggregations are brought about by an even more complex mechanism than the above type. Here a series of physical factors interacts simultaneously to guide the beetles to their aggregation sites. The earlier studies of the present author (PULLIAINEN 1963, 1964) have shown that light, temperature and humidity conditions are such physical factors in the case of *M. 18-guttata*.

According to the present observations, it seems that a thigmotactic component plays an important role in the hibernation of *M. 18-guttata*. On the butts of pines the crevices of the bark form suitable places for this purpose. The number of such places on a pine is limited, however. They are naturally most numerous on the butts of the trees. This partly explains why most of the aggregations were at a height of 1 – 10 cm above the ground. Another factor connected with this problem is snow conditions. When hibernating in the litter and low on the butts of pines *M. 18-guttata* specimens are well sheltered by snow cover against cold.

From the microclimatic point of view (see e.g. HAARLØV & PETERSEN 1952, CLOUDSLEY-THOMPSON 1962) it seems sensible that most of the *M. 18-guttata* specimens should hibernate on the east and south sides of the pines, which are warmed by the sunshine. However, it is interesting to note that there was no difference between the numbers of lone specimens and aggregations on these two halves of the pines. The aggregation tendency was greater on the east and south sides of the pines than on the other sides of these trees.

There were also other coccinellid species to be found in the hibernation sites of *M. 18-guttata*. The commonest species in my study area was *Scymnus suturalis* THBG. In many cases *M. 18-guttata* specimens were on the outer sides of the aggregation and small *S. suturalis* specimens in the middle of the aggregation. *Abhidecta obliterata* L. was also found in many aggregations of *M. 18-guttata*. Some specimens of the following species were found in the places in question: *Anisostica novemdecimpunctata* L., *Coccinella hieroglyphica* L., *Propylaea quaturodecimpunctata* L. and *Paramysia oblongoguttata* L., too. The situation that there are different coccinellid species in the same aggregation very well describes the strong aggregation tendency of these beetles.

During the laboratory experiments (see also PULLIAINEN 1964, p. 121) the great aggregation tendency of *M. 18-guttata* was also visible.

Summary.

1. Observations on the hibernation sites of *Myrrha 18-guttata* were made on a rather dry pine peat-bog in the western part (Haaga) of the city of Helsinki 17. – 22. III. 1964. This coccinellid hibernates in crevices in the bark on the butts of pines. 100 aggregations and lone specimens from about 40 pines ($D_{1.3}$ = 13 cm) taken at random were studied. The total number of specimens recorded was 302.

2. 93 % of the aggregations and lone specimens were situated at a height of 1 – 10 cm above the ground.

3. In 28 % of cases the specimens were alone in the crevices. The mean size of the aggregations (two specimens or more) was 3.8. The greatest aggregation consisted of 14 specimens.

4. The total number of specimens on the east and south sides of the pines was greater than on the west and north sides of the trees. The corresponding difference between the numbers of lone specimens and aggregations was not significant.

5. The thigmotactic component is concluded to be an important factor in the hibernation and aggregation of the species.

6. The hibernation ecology of the species is discussed.

7. Other coccinellid species were found in the aggregations of *M. 18-guttata*. The commonest species were *Scymnus suturalis* and *Aphidecta obliterata*.

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References: Cloudsley-Thompson, J. L. 1962. Microclimates and the distribution of terrestrial arthropods. Ann. Rev. Ent. 7, p. 199 – 222. — Greenslade, P. J. M. 1963. Aggregation in British Carabidae (Coleoptera). Ent. Mon. Mag. 99, p. 202. — Haarløv, N. & Petersen, B. B. 1952. Measurements of temperature in bark and wood of Sitka spruce (Picea sitchensis) with special reference to temperature in galleries of Hylesinus (Dendroctonus) micans. Forstl. Forsøksvaesen Den. 21, p. 1 – 91. — Hagen, K. S. 1962. Biology and ecology of predaceous Coccinellidae. Ann. Rev. Ent. 7, p. 289 – 326. — Hodek, I. 1960. Hibernation-bionomics in Coccinellidae. Acta Soc. Ent. Čechosl. 57, p. 1 – 20. — Pulliainen, E. 1963. Preliminary notes on the humidity reactions of Myrrha 18-guttata L. (Col., Coccinellidae). Ann. Ent. Fenn. 29, p. 240 – 246. — 1964. Studies on the humidity and light orientation and the flying activity of Myrrha 18-guttata L. (Col., Coccinellidae). Ibid. 30, p. 117 – 141. — Salmela, K. 1938. Ekologinen tutkielma havuneulaskarikkeen kovakuoriaiseläimistöstä Nousiaisissa. (Ref.: Zur Kenntnis der Käferfauna der Nadelstreu in Nousiainen (Südwest-Finnland), ökologische Studie.) Ann. Univ. Turkuensis A VI 13, p. 1 – 45.