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On the Life Cycle of *Epilachna admirabilis* (Coleoptera,
Coccinellidae) in Sapporo, Northern Japan, with
Special Reference to its Hibernation
by Adult Stage

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Synopsis The life cycle of the phytophagous ladybird, *Epilachna admirabilis* CROTCH, feeding upon *Schizopepon bryoniaefolius* MAXIM. and *Gynostemma pentaphyllum* (THUNB.) MAKINO in Sapporo, northern Japan, is briefly described. This species is univoltine and hibernates as the final (4th) instar larvae. Overwintered larvae pupate in mid June to early July and adults come out from late June. Most adults die off until late August but some enter the second hibernation in late September to early October with the final instar larvae and survive at least in the next mid June.

The phytophagous ladybird, *Epilachna admirabilis* CROTCH, occupies the unique position among coccinellid beetles by its larval hibernation. Most coccinellids hibernate by the adults (cf. HODEK, 1973) while *E. admirabilis* by the final (4th) instar larvae (TAKAHASHI, 1932; KAWANO, 1934). In the course of my study on the biology of *Henosepilachna vigintioctomaculata* (MOTSCHULSKY) feeding upon *Schizopepon bryoniaefolius* MAXIM., numerous *E. admirabilis* were found on *S. bryoniaefolius* and *Gynostemma pentaphyllum* (THUNB.) MAKINO (both belonging to Cucurbitaceae) in Maruyama, Sapporo. In the present paper a brief description will be given on the life cycle of *E. admirabilis* based upon the periodical observations made in 1975 at Maruyama, with special reference to twice hibernations in some individuals, one as the final instar larvae and another as adults, which is, as far as I am aware, quite exceptional among coccinellid beetles.

Before going further, I wish to express my sincere gratitude to Dr. Shôichi F. SAKAGAMI for his critical reading of the manuscript.

Area Surveyed and Method

Weekly census was made from late May to mid October at the natural broad leaved forest of the northern slope of Maruyama, in the vicinity of Sapporo. *S. bryoniaefolius* and *G. pentaphyllum* were abundant there and fed by *E. admirabilis*. Three subareas were selected and a 30-minute census was performed on each census day for the adults fed upon *S. bryoniaefolius* in each subarea (in total 90 min. per

day). Immature stages simultaneously observed in each census was recorded. Results obtained by extra-routine observations for eggs, final instar larvae and pupae were also incorporated.

Results and Discussions

Phenology of *E. admirabilis* in Maruyama is given in Fig. 1 with the number of adults counted by 90 min. census (30 min. \times 3) and immature stages observed on each census day. The census was chiefly focused on adults so that some immatures, especially pupae and eggs, might be overlooked in each census. But the results suggest an approximate figure of seasonal incidence of successive immature stages. Final instar larvae overwintered in the leaf litter near the places where host plants grew become active in late May. They pupate from mid June and the adults come out between late June and mid July, resulting in a steep increase of the number of adults in this season (cf. Fig. 1). Adults oviposited from mid July to mid August and mostly disappear until late August. Young larvae emerged in early August and enter the hibernation in late September to mid or late October by final instar.

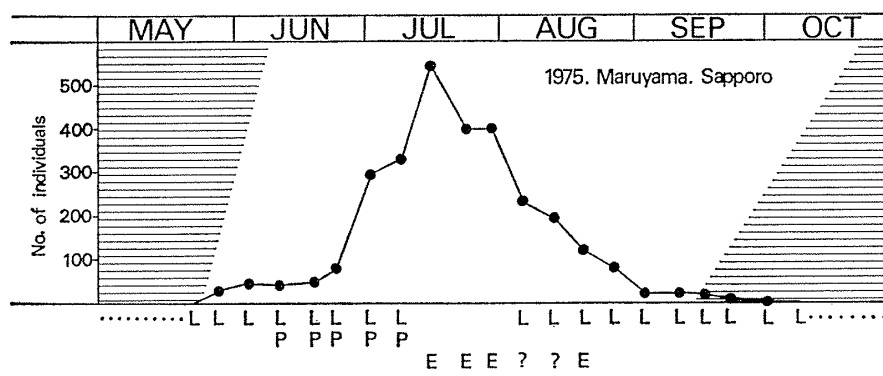


Fig. 1. Phenology of *E. admirabilis* in Sapporo, indicating the number of adults counted in 90 min. census (30 min. \times 3) and immature stages confirmed on each census day (L: larvae, P: pupae, E: eggs). Shadow shows the approximate period of hibernation.

However, some adults are still observed until early October. Moreover a few adults are discovered already in late May when the post-hibernating larvae still do not pupate. This suggests that some adults enter in the second hibernation. The assumption was confirmed by the following fact: The unique individual out of five ones marked in July, 1974 was recaptured on May 28, 1975. As far as my observations go, *E. admirabilis* has only one generation per year (cf. Fig. 1). Further the recaptured individual mentioned above indubitably emerged in or before the last summer. Consequently the adults observed in late May to mid June are regarded as passed their second winter by the adult.

Such extra seasonal adults are not exceptional to the population in Maruyama*, being also observed at Mt. Yôtei (HINOMIZU, pers. comm.). On the other hand, both TAKAHASHI (1932) and KAWANO (1934) who studied the life history of *E. admirabilis* in Tokyo, central Japan, did not refer to the hibernation by adults. As the number of individuals studied by them is small, adult hibernation might be overlooked. Closer reexamination is necessary for the populations inhabiting in the areas other than Hokkaido. Although the mechanisms which lead adult of *E. admirabilis* to hibernation is unknown, it is difficult to regard such adult hibernation as a result of mere quiescence by coldness as far as the severe winter of the area studied is taken into consideration. Maruyama is covered with snow from late December to early April. Since *E. admirabilis* usually hibernates by mature larvae, the hibernation by adult seems vain. But whether hibernated adults breed again or not, and if breed, how they contribute to the population is yet unknown, requiring examination of the development of their gonads.

TAKAHASHI (1932) and KAWANO (1934) reported that adults of *E. admirabilis* emerged at least in early June in Tokyo**, but not oviposited until early August. On the other hand, adult in Maruyama emerged in late June to mid July and began oviposition in mid July. This difference of pre-reproductive period in adults between two populations suggests that some environmental factors, such as the change of day length or thermal conditions, affect the development of gonads.

References

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 KAWANO, T., 1934. Studies on the life history of *Epilachna admirabilis* CROTCH. *Kontyû, Tokyo*, 8: 138-152. (In Japanese.)
 TAKAHASHI, S., 1932. Studies on *Epilachna* lady beetles in Japan. *J. Tokyo Nôgyô Daigaku*, 3: 1-115.

* If extra seasonal adults still survive in mid July and if all post-hibernating larvae could become adults, approximate ratio of individuals hibernated by adult to the whole hibernated individuals falls ca. 8%.

** Since both TAKAHASHI and KAWANO did not treat the results by field observation and laboratory experiments separately, there still remain some obscurities on the life cycle of *E. admirabilis* in Tokyo.