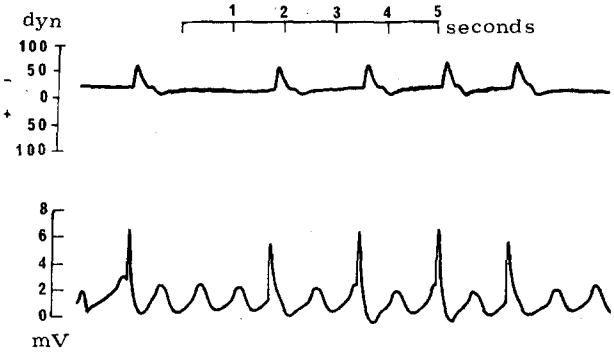

Fig. 3. Recording from 'fatigued' preparation. Regular appearance of slow waves, most of which are sub-threshold. Action potentials and increases in force at irregular intervals.

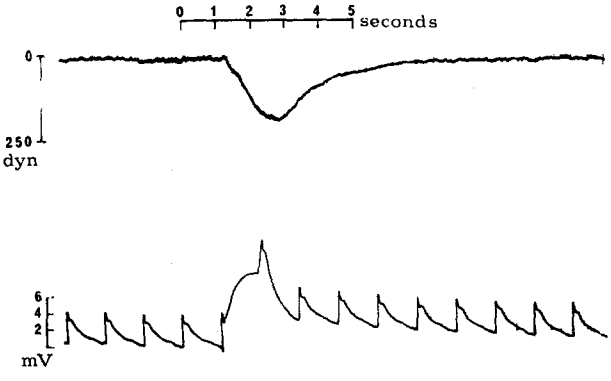

Fig. 4. Recording from 'fatigued' preparation. Focal discharge of action potentials at high frequency. A single synchronized contraction occurs in the record.

experiments were sometimes preceded by slow depolarizations resembling pacemaker potentials (Figure 2 and 3).

The strict correlation between electrical and mechanical activity in most of the present experiments (Figure 1), indicates that a single pacemaker regulates rhythmical contraction of a whole segment of vein between 2 valves. This mechanism may play a significant role in promoting venous return from the bat's wing. More complex patterns of mechanical activity with partial dissociation of electrical and contractile events (Figure 2) might occur in the in vitro situation as a result of traumatic interference with the mechanisms of synchronization. However, a phenomenon of 'active dilatation' has previously been observed in vivo in the intact vessel, particularly when the perfusing pressure was artificially reduced by 10–20 cm H_2O (PERISTIANY and HUGGEL[3,4]). It was considered that this mechanism may contribute to the regulation of local blood flow in the bat's wing.

Zusammenfassung. Die isolierte pulsatile Flughaut-Vene der Fledermäuse zeigt mit dem «Sucrose-gap» eine enge elektro-mechanische Korrelation. Das AP ist oft von einem Schrittmacher-Potential eingeleitet. Solche AP sind äusserst selten bei den Gefässmuskeln.

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[9] This study was supported by grants from the Swedish Medical Research Council (28-14 x), the G. and A. Claraz-Schenkung and the Swiss National Scientific Research Funds, and was carried out in the Department of Physiology, University of Lund, Sweden.

A Comparative Study of Growth, Development and Survival of the Cricket *Plebeiogryllus guttiventris* Walker Reared Singly and in Groups

The phenomenon of 'group effect' has been reviewed by CHAUVIN[1] in orders like Lepidoptera, Coleoptera and Orthoptera and some Social insects. CHAUVIN[2] has also shown that rearing of *Acheta domestica* in groups of 2 or 3 insects accelerated better growth, and in groups of 5 and 10 slowed down the growth compared to the rearing of single larvae. MC FARLANE[3] working with the same insect found that rearing of larvae in groups of 10 accelerated growth better than single rearing. Since the two authors used different rearing jars the differences in their results suggest that the group effect for optimal growth does not depend on the absolute number of individuals per group but on the relative number per unit of volume or area. So far no work on the group effect in *Plebeiogryllus guttiventris* is on record. An experiment was therefore conducted to discover the effect of grouping on the growth, development and survival of this cricket. The present paper deals with the comparative study of such effects and also suggests that a group of 10 accelerated better growth than any other group.

[1] R. CHAUVIN, *The World of an Insect* (George Weidenfeld and Nicoloson Limited, London 1967), p. 81.
[2] R. CHAUVIN, J. Insect Physiol. *2*, 235 (1958).
[3] J. E. MCFARLANE, Can. J. Zool. *40*, 559 (1962).

Table I. The number and average weights of nymphs of *P. guttiventris* reared singly and in groups after 10, 20 and 30 days

Time (days)	Single		5		10		15		20	
	No.	wt (mg)	No.	wt (mg)	No.	wt (mg)	No.	wt (mg)	No.	wt (mg)
Commencement	60	—	60	—	60	—	60	—	60	—
10	49	5.6	33	6.5	52	7.1	45	6.8	41	5.9
20	34	23.0	31	26.3	51	29.3	41	25.4	39	20.5
30	34	42.5	30	114.0	49	137.7	41	126.5	34	98.7

Table II. Number and average weight of adults obtained, average duration of nymphal stage and percentage survival of singly-reared and group-reared nymphs of the cricket, *P. guttiventris*

Treatment	Adult males obtained			Adult females obtained			Total		Survival[b]
	No.	Duration of nymphal stage (days)	Wt (mg)	No.	Duration of nymphal stage (days)	Wt (mg)	Duration (days)	Wt (mg)	Survival[b] (%)
Single	10	47.0 (44–51)[a]	137.7 (115–176)[a]	16	44.9 (42–48)[a]	157.9 (105–205)[a]	45.9	150.0	43.3[a]
5	14	42.0 (37–45)	185.0 (110–225)	18	39.2 (36–44)	196.7 (152–258)	40.6	190.6	53.3[a, b]
10	23	37.4 (34–44)	209.9 (165–271)	25	36.0 (33–41)	226.4 (160–287)	36.7	218.5	80.0
15	20	40.5 (36–46)	187.6 (139–225)	18	37.8 (34–42)	194.9 (121–235)	39.1	191.1	63.3[b]
20	14	45.6 (40–50)	165.8 (125–193)	15	43.7 (38–47)	167.4 (117–220)	44.4	166.8	48.3[a, b]

[a] Range. [b] Values with same letter are not different at 5% level.

Materials and methods. The rearing methods have been described elsewhere[4]. The newly hatched nymphs of an 11th generation were used for this experiment. They were selected at random from the same population within 24 h of hatching. There were 60 nymphs in each series with the following 5 treatments: 1, 5, 10, 15 and 20 individuals per group and jar. The nymphs were reared on concentrated poultry feed[5] in 30 oz(852 ml) jars at 35 ± 1 °C as these proved to be the most suitable for their growth, development and survival. The RH maintained was 50 ± 5%. The nymphs were transferred at weekly intervals to clean jars containing fresh diet, a folded filter paper (15 cm × 3.75 cm) and a water vial. They were weighed after 10, 20, and 30 days and also after reaching the adult stage. The dates of adult emergence and their sex were also recorded.

Results and discussion. The results are presented in Tables I and II. Better results were obtained with groups of 10 insects as they showed minimum duration of nymphal development with maximum average weights at any time of their life (Table I) and a significantly higher percentage of survival than any other group (Table II). Survival in groups of 5 and 15 was not significantly different, though significantly higher in the latter than that of singly reared insects. These, and nymphs reared in groups of 20, showed highest mortality, maximum duration of nymphal development and minimum average weights. The results indicate that under our rearing conditions 10 individuals per jar represent the optimal group size.

The contradicting finding of CHAUVIN[2] that groups of 5 and 10 insects of *A. domestica* showed a slow development is probably due to the fact that he used small containers of 30 ml and 75 ml capacity which might have led to crowding already in relatively small groups. He also used diets and a species different from our own. However, the diet is probably not important, since MCFARLANE[3] found better growth of *A. domestica* in groups of 10 individuals, i.e. a value which corresponds to our finding in *P. guttiventris* though the diets he used were different. The volume of his containers was 16 oz (473 ml) whereas ours was 30 oz (852 ml). Unfortunately the optimal size of the groups has not been determined by MCFARLANE. If in *A. domestica* groups of 10/16 oz container would represent the optimal group density, the difference to our results would represent a true species specific difference. However, more than by the volume of the container, the optimal size of the group may be influenced by the surface area of the paper fold provided for rest, movement and moulting of the insects, i.e. by the true density of the crickets. This aspect has not been discussed elsewhere. In our experiment each container had a base area of 30 cm² and the paper fold had a surface area of 112.5 cm². Thus in a group of 10, each insect had an average area of 14.25 cm² which has proved to be optimal. Concerning the percentage of survival, MCFARLANE[3] obtained approximately the same result whether he reared the nymphs singly or in groups of 10, whereas in our experiment a clear cut optimum was found. High mortality in groupings of 20 insects may be attributed to a comparatively small size of the container which might have led to over-crowding, whereas high morality in the case of single rearing might be due to the absence of jostling and mutual stimulation as suspected by PETTIT (1940, cited by GHOURI[6]) for *Blatella germanica.*

Our observations led to the conclusion that the grouping of 10 in case of *P. guttiventris* is well suited for better growth, faster developement and high percentage of survival[7].

Résumé. Nos observations nous permettont de conclure que le groupement de dix nymphes de *Plebeiogryllus guttiventris* est bien apte au meilleur accroissement, au développement plus rapide et offre une proportion plus élevée de survivance.

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[7] Acknowledgment: The authors are thankful to Karnatak University, Dharwar and University Grants Commission, New Delhi, for financing the work. Thanks are also due to Dr. M. APPASWAMY RAO, Head, Zoology Department for encouragement and for providing the necessary facilities and also to Dr. K. PAMPAPATI RAO for critical appraisal of the work.