10 Summary

This study explores (i) the systematic distribution of maternal care in Southeast Asian treehoppers (Homoptera: Membracidae) and (ii) the behavioral ecology of maternal care in *Pyrgauchenia tristaniopsis*. In addition, its taxonomy and features of its life-history, reproductive biology and morphometry necessary for interpreting data on maternal care were studied.

The results (1) do not support the strong version of the semelparity-hypothesis (one reproductive event per reproductive season is a precondition for maternal care in insects) and show (ii) that, contrary to previous suggestions, maternal care in Old World Centrotinae is no ecxeption. Also, basic biological features of a Southeast Asian species of the family Membracidae were studied for the first time.

Vegetation was sampled from 1996-1998 in 16 rainforest plots in West-Malaysia and Sabah (Borneo). Maternal care (egg-guarding) was present in 11 species from the genera *Pyrgauchenia, Pyrgonota, Hyandoides, Gigantorhabdus* (Hypsaucheniini), *Centrochares* (Centrocharesini), and *Ebhul* (Ebhuloidesini). Their nymphs lived gregariously.

Three new species are described (*Pyrgauchenia biuni, P. pendleburyi, P. tristaniopsis*). Two nominal species (*P. angulata* Funkhouser und *P. brunnea* Funkhouser) are placed as junior synonyms of *P. colorata* Distant.

Pyrgauchenia tristaniopsis was studied in the lower montane forest of Kinabalu National Park (Borneo). This species was found only there (between 1350 m and 1650 m a.s.l.). It was polyphagous with all developmental stages occurring on 11 plant species from 8 families. There were 5 nymphal stages taking together 63-83 days to develop (22 days for development of eggs). Nymphs lived gregariously and were tended by ants (total of 4 morphospecies). Circumstantial evidence suggests that adults stayed in aggregations for about 10 days after ecdysis. After ecdysis, it took females and males not more than 5 and 10 days, respectively, to copulate for the first time. To initiate mating, a male settled on a female for 138 sec (median, precopula) and sometimes mated with her taking 116 minutes (median) for one copulation. The male produced vibrational signals while in precopula. *P. tristaniopsis* was promiscous with some females copulating while guarding eggs. At ecdysis, sex ratio was even. From a cohort analysis, egg-mortality was estimated to be 35 %. Salticid spiders were the most frequent predators on nymphs and adults. Eggs were parasitized by *Brachygrammatella* sp. (Trichogrammatidae).

Eggs were placed in clutches into the tissue of host plant twigs. Egg numbers per clutch (about 57) increased with duration of maternal egg-guarding. Females were not found to

prefer the part above or below an egg clutch for oviposition. As a mean, 3 and 4 (1998 and 1997, respectively) clutches occurred together on one twig. In a mark-recapture experiment, at least half the females produced at least two clutches during their lifetime. Oviposition of second clutches found with females started 5 days (mean) after leaving the first clutch found. Usually, „second“ clutches were placed on the same host plant individual as was the „first“. The females' fat bodies increased again after oviposition while guarding a clutch.

After oviposition, mothers sat for 26-28 days on their egg clutch, i.e., 5-8 days after the onset of egg hatch (first-instar nymphs hatched successively with the majority of instars having hatched only 9 days after the first had hatched). Upon removal, females returned onto their clutches. In a choice experiment, however, females did not prefer their own egg clutch to that of conspecifics. When disturbed, guarding females always retreated sideways and started their relocation search with movements to the sides. Experimentally arranged contact with the egg parasitoid *Brachygrammatella* sp. sufficed to increase the frequency of leg-scraping by females. The frequency of leg scrapes depended on daytime and on whether females guarded eggs.

Egg-guarding improved egg survival: egg mortality increased when the duration of female egg-guarding was shortened experimentally (independent of egg number per clutch). Egg-guarding postponed oviposition of a second clutch, as shown by experimentally shortening the time of egg-guarding of the present clutch.

Breaking of the dorsal pronotal process did not reduce mating probability: the frequency of copulating males and females with broken processes equalled their frequency in the population. The dorsal process was broken off in 52 % of all egg-guarding females. Females were longer and heavier than males as were some pronotal characters, e.g., the posterior process. Males of the same body length, however, had longer dorsal processes and distal lobes than females. Siblings were similar in their weight, body length and length of dorsal process. This may be explained by large heritabilities, similar environments, and/or inbreeding.