Factors controlling reproduction of certain Namib Desert tenebrionids

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Althought tenebrionid beetles are probably the best studied insect group of the Namib Desert (e.g. Gebien 1938; Koch 1960, 1961, 1962a, 1962b, 1969; Schulze 1962; Kühnelt 1969; Holm 1970; Edney 1971a, 1971b; Louw and Hamilton 1972; etc.) most of the studies have concerned themselves mainly with taxonomy and, more recently physiology, behaviour and ecology. No investigation known to date has endeavoured to establish if reproductive cycles exist, or to evalute the factors controlling time of reproduction of desert tenebrionids in their natural habitat. This study was undertaken as a first attempt to partially fill this important gap in the available information relating to these most interesting and extremely well-adapted desert insects.

PROCEDURE

Pit traps in conjunction with simple hand collection were employed to collect approximately thirty beetles of each species; these were made towards the middle of each month. Only females of the two most common tenebrionids *Onymacris plana* and *O. rugatipennis* were collected. All beetles used in this study were collected not less than five but not more than fifteen km from the Namib Desert Research Station at Gobabeb so the weather data would be applicable. The beetles were immediately killed and preserved in 70% ethanol until the eggs present in the abdominal cavity could be counted. The eggs themselves, up to 7,0 mm in length, were easily visible by eye but counting was performed with the aid of a dissecting microscope to avoid errors. Pertinent weather data were extracted from information collected at Gobabeb as part of the permanent meteorological research programme of the Namib Desert Research Station.

RESULTS AND DISCUSSION

Developed eggs, when present, were easily visible. *Onymacris plana* females were found to contain up to eight eggs per individual, the maximum size recorded being 7,0 x 2,0 mm. *O. rugatipennis* females were found with up to ten eggs and a maximum size of 4,5 x 1,8 mm while *O. laeviceps*, which were also collected for a short period, contained up to twelve eggs of 6,5 x 2,0 mm maximum dimensions. The percentage of female *Onymacris plana* and *O. rugatipennis* found with eggs in any month over a two year period are shown in Fig. 1. Maximum and minimum temperatures and precipitation in the form of rain are plotted in the same figure. It would appear that reproduction can occur at any time but is stimulated and sustained by extraordinary precipitation in the form of rain.

Holm (1970) has shown that *Onymacris plana* occurs in the dunes during the entire year but their numbers increase tremendously following rain. *O. rugatipennis*, although normally an inhabitant of the dry Kuiseb riverbed, also increased numerically

in the dune area following rain early in 1969. The same species was observed to increase in its more usual riverine forest habitat as well. Both the above species are more numerous during the summer than during the winter while *Onymacris laeviceps* has a similar annual cycle but is generally less abundant. Although the total number of active individuals varied throughout the year, it is assumed that the random sample collected represented the average condition of the entire population with respect to gravid females. Likewise it was assumed that the percentage of immature and non gravid females would remain constant.

In most birds, mammals and reptiles the photoperiod is probably the most important external stimulus for reproductive activity, while in some species either temperature or rainfall are of equal

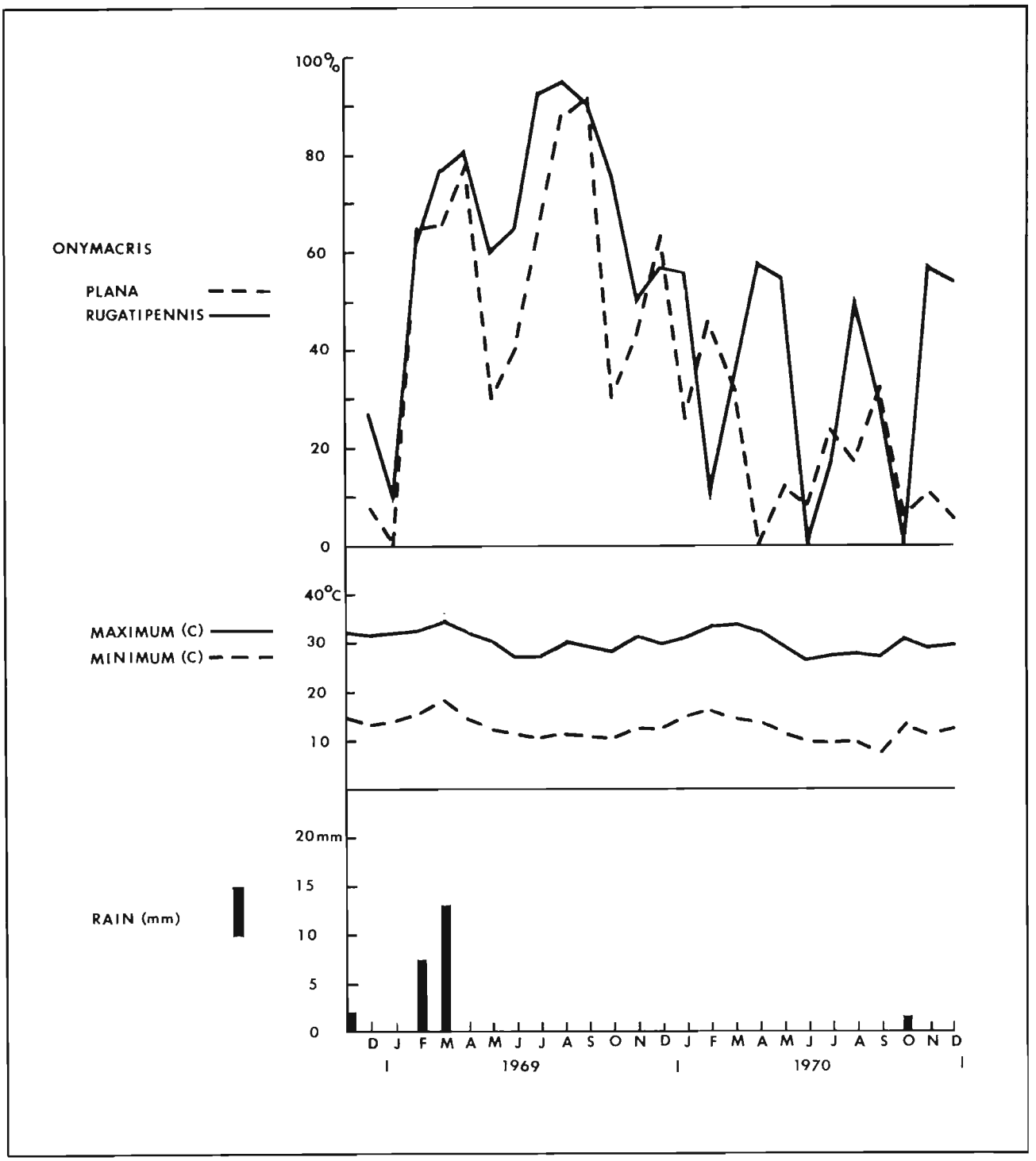

Figure 1. The percentage of gravid females of *Onymacris plana* Peringuey, *Onymacris rugatipennis* Haag, plotted by month over a period of two years. Maximum and minimum monthly average temperature are included together with total rainfall for each month.

or more importance (Prosser and Brown 1961). In the case of insects it has been found that climate and nutrition are usually the most important environmental factors controlling reproduction (Clark 1967).

Dune dwelling Namib tenebrionids are thought to feed predominantly on wind borne vegetal detritus which accumulates on the lee sides of dunes (Koch 1960) while those tenebrionids living in the dry riverine forest habitat consume mainly forest detritus in addition to some which is wind distributed. Water, in limited amounts, is regularly available in the form of dense, advective fogs. Precipitation of fog onto the detritus as well as sorption of moisture from unsaturated air onto these dry particles (Tschinkel 1972) probably provides the usual main source of available moisture for the dune and riverine forest dwelling tenebrionid beetles. Under these normal conditions of food and water availability a variable amount of reproduction occurs (Fig. 1, 1970 data).

Rain in the dune Namib results in an increase of available food in the form of new annuals and increased growth of the perennial vegetation. In addition more plant material is present to augment the wind-blown detritus and thus become available in this form. In 1969 Holm (1970) found approximately a nine-fold increase of the total population of *Onymacris plana* and a seven-fold increase of *O. rugatipennis* in the dunes as a result of the February and March rains. In the present study these same rains were found to cause an increased percentage of gravid females over a sustained period (Fig. 1, 1969 data). Thus the data in Fig. 1 seem to indicate that rain with its subsequent influence upon the food available to the beetles has a very significant and long-lasting effect upon the reproductive rate while the effect of temperature, if any, is not clear. It is hoped that further investigations along these lines will be conducted with other Namib dwelling species in various habitats to further elucidate the environmental factors controlling reproduction in the desert habitat.

SUMMARY

Two years of reproduction data for two species of Namib tenebrionids are presented and compared with temperature and rainfall data for the same period. Rain, probably by influencing food abundance, is shown to have a significant and sustained effect upon the percentage of gravid females in the population during any one month while the effect of temperature is not clear.

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