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EFFECT OF 25-AZACOPROSTANE ON THE GROWTH AND REPRODUCTION OF THE BUG *DYSDERCUS SIMILIS*

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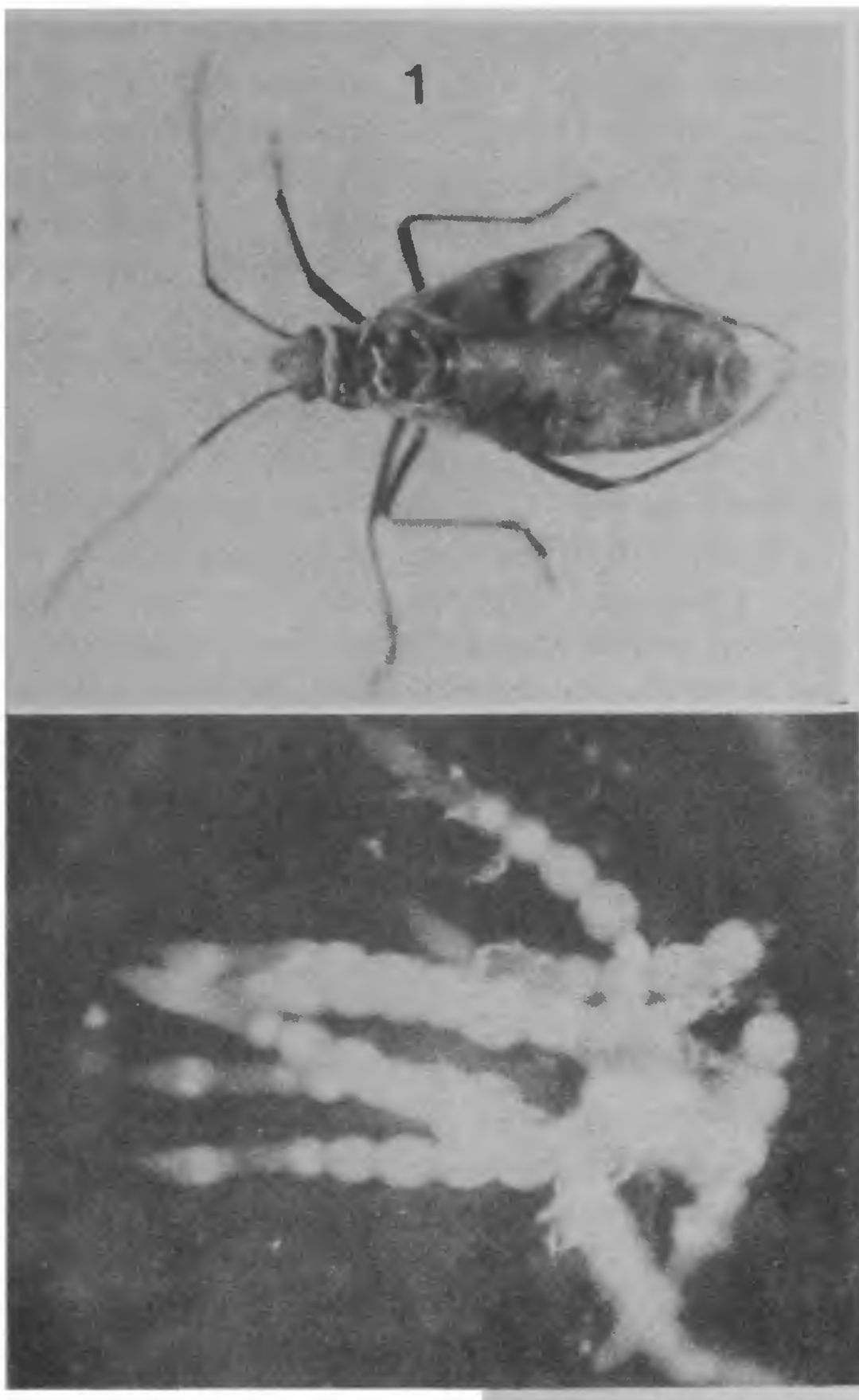
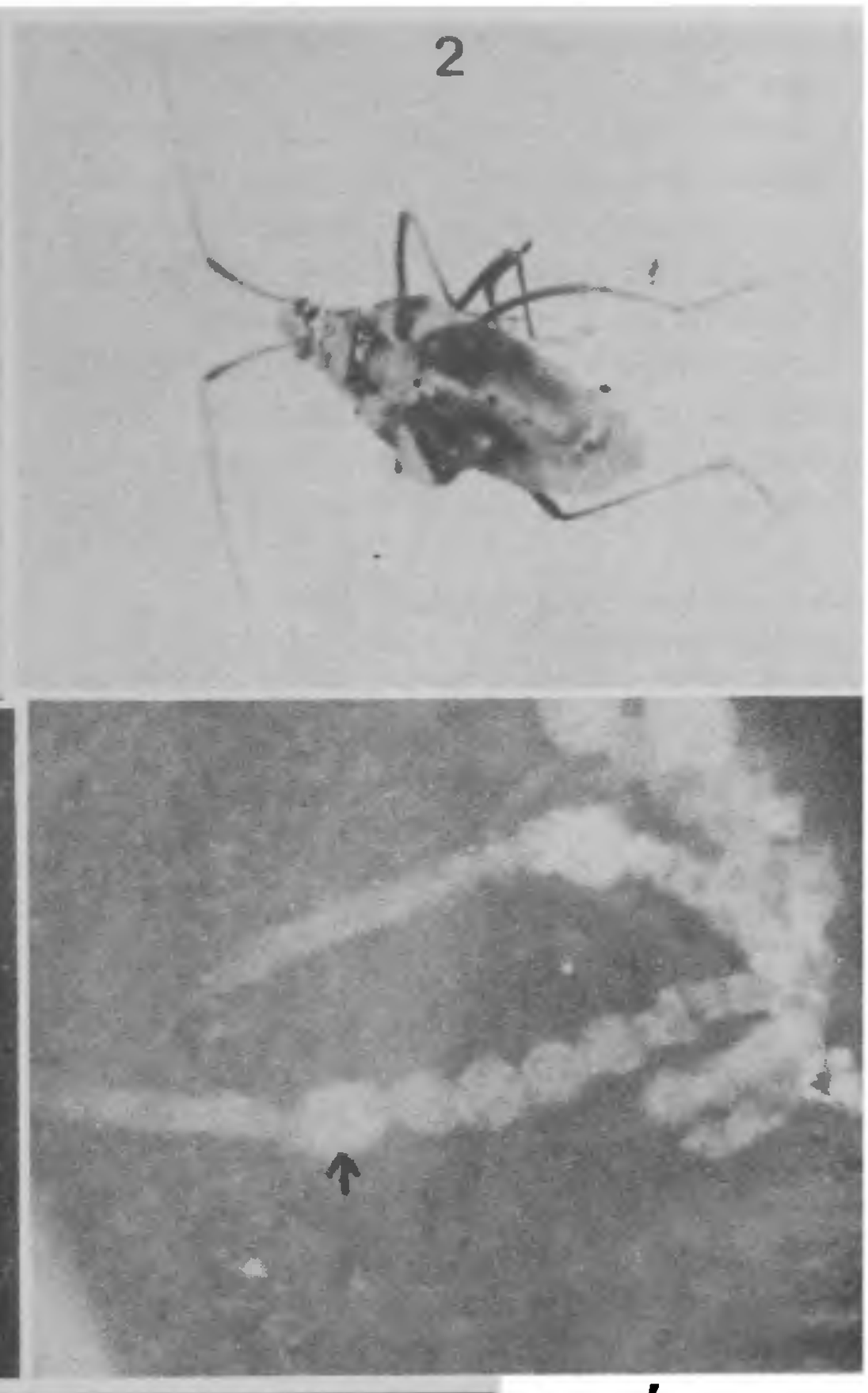
STUDIES based on the structure and biological activity of certain compounds which inhibit insect growth and development permitted the design and synthesis of a number of azasteroids which considerably enhance the growth and the development inhibitory activity[1]. One of these compounds, 25-azacoprostane, was tested on the insect *Dysdercus similis* for its growth-regulating activity.

The bug *Dysdercus similis* was reared at 27° ± 1 C and RH of 65 ± 5 % and fed on soaked cotton seeds. The freshly ecdysed fifth instar nymphs were topically treated on the abdominal tergum with 1 µl/insect of varying concentrations of the compound 25-azacoprostane (5 β-cholan-24-dimethylamine). The concentrations ranged from 500 to 2000 ppm. One µl of 1000 ppm/insect was the concentration at which the activity was maximum. Controls were treated with 1 µl/insect of the carrier solvent acetone. The experiments were repeated thrice. The abnormalities after ecdysis in the treated insects and their gonads were recorded.

The freshly ecdysed fifth instar nymphs when treated with 1 µl/insect of 1000 ppm of 25-azacoprostane, moulted after 12 to 15 days into abnormal forms while the controls moulted into adults after 7 to 8 days. This prolongation in the life span of the final instar larva was also observed by Chippendale and Reddy[2]. Sixty per cent of the treated nymphs moulted into adults with malformed wings. The wings were short, less melanized, crumpled and often varied in length. (figure 1). The testes of these adults were oval-shaped, and the vas deferens was thin tube-like or bulbous and short. The accessory glands also varied in size in most of the treated adults (figure 5). Wing malformation in the adults as a result of the steroid was reported[3]. The ovaries of these malformed adults had 5 to 6 oocytes in each ovariole. They showed yolk deposition but the size of the oocytes was much less than the oocytes of control insects (figure 3). Ovarian development and egg viability hindered by the steroids in the adults with malformed wing was reported earlier[4-7]. Thirty per cent of the treated nymphs moulted into adultoids having short wings, two to three segmented antennae, with curved appendages of varied lengths. The tarsus was unsegmented in most cases (figure 2). The male reproductive system was like that of the normal adult but the females showed abnormalities. The number of oocytes was reduced to 2 to 3 in most cases. Vitellogenesis was hindered. In certain cases the oocytes varied in size in an ovariole, the larger occupying the distal position (figure 4). These oocytes showed that the yolk deposition was drastically affected. Fecundity and hatchability were considerably reduced. A small per cent (10 %) of these were unable to extricate properly and the exuviae was found attached to the appendages or to the abdomen. Such insects died in a





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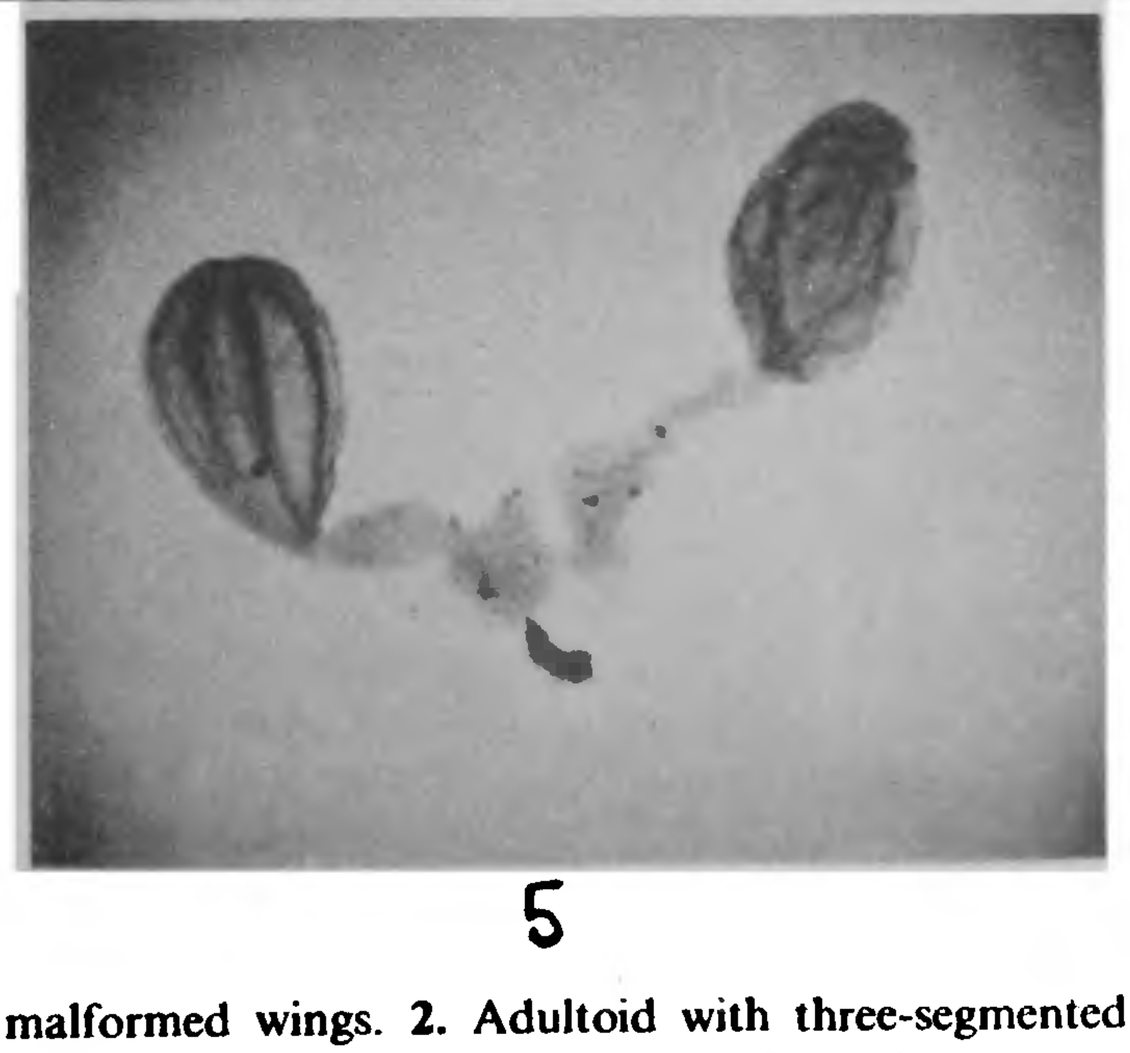

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Figures 1–5. 1. Adult with malformed wings. **2.** Adultoid with three-segmented antennae and crooked appendages. **3.** Ovary of adult with malformed wings. **4.** Ovary of an adultoid showing large distal oocytes (arrow). **5.** Whole mount of the male reproductive system of the adult with malformed wings showing bulbous and tube like vasa deferentia.

day or two. Disruption of normal moulting and development in certain insects was reported by Svoboda *et al*[1].

Our results demonstrated that 25-azacoprostane disrupted the normal growth, moulting and reproduction by interfering with the hormone biosynthesis and metabolism in *Dysdercus similis*. This compound can thus be used as a safe insect control chemical.

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INSECT-FERN INTERACTIONS WITH PARTICULAR REFERENCE TO *HELIOTHRIPS HAEMORRHOIDALIS* (BOUCHE) (THYSANOPTERA: PANCHAETOTHRIPINAE)

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RESISTANT factors in ferns such as texture[1], toxins[2,3], exogenous ecdysone[4,5], presence of thiaminase[6], cyanogen[7], and poor nutritional composition including aminoacid deficiency[8] have been generally reported to render them unfit to be utilized by insects. Recent work on this aspect however revealed that insects like *Megacopta* (=*Coptosoma*) *siamicum* (Fabr.)[9], *Micromyzodium filicum* David, *Micromyzus nigrum* van der Goot (Aphididae:Homoptera) and *Kolla tigrina* Distant (Cicadellidae:Homoptera) efficiently utilize the fern host for their growth and development[10]. Information presented here on the polyphagous, cosmopolitan thrips, *Heliothrips haemorrhoidalis*, often infesting the fern, *Polypodium phegopteris* in glass houses pertains to utilization of this fern host for their survival and development.

Infestation of *H. haemorrhoidalis* on *P. phegopteris* is mostly resticted to mature fronds where they feed on both the abaxial and adaxial surfaces leaving white silvery patches with numerous minute blackish markings caused by deposition of faecal matter by the larvae. Both sexes occur on the same leaves and mating was also evident in contrast to parthenogenetic reproduction on coffee leaves. The male:female ratio on *P. phegopteris* was 3:25. The duration of life-cycle ranged from 20 to 30 days, both immatures and adults were collected in large numbers on this host from Valparai (Anamalais) and Ooty (Nilgiris). Interestingly this thrips-fern association was observed only at altitudes above 1,900 meters.

To assess the impact of the chemical factors (lipid, phenol, carbohydrate, nitrogen and protein) involved in host selection/preference, ten fern hosts including *P. phegopteris* were analyzed biochemically. Young fronds not preferred by *H. haemorrhoidalis* had only 8 mg/g of lipid whereas the mature fronds which attract the insect had a comparatively high lipid concentration (12 mg/g) and not much variation was evident in carbohydrates, phenols and proteins between the juvenile and mature fronds (figure 2). Further, the different chemical compounds were present in various concentrations in different fern hosts (figure 1). *P. phegopteris* was the preferred host of this thrips because of the higher concentrations of proteins and nitrogen (43 mg/g and 7% respectively). To assess the quantitative changes in the chemical composition of *P. phegopteris*, due to the infestation of *H. haemorrhoidalis*, the host plant at three different stages, i.e. juvenile fronds, mature fronds with sori and the infested fronds were subjected to biochemical analysis. Variations exist between the juvenile and mature fronds with respect to lipid concentration (8 mg/g in juvenile fronds and 12 mg/g in mature fronds), but no quantitative reduction was evident between the uninfested and infested mature fronds. However, quantitative loss in the total carbohydrate, phenols, and nitrogen content was observed in the mature fronds (figure 1) indicating that *H. haemor-*