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A COMPARATIVE ACCOUNT OF THE INTERNAL REPRODUCTIVE ORGANS IN FAMILY CHRYSOMELIDAE (COL.) III. SUBFAMILIES CLYTRINAE, CRYPTOCEPHALINAE AND CRIOCERINAE.

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Male and female reproductive organs of 34 chrysomelid species belonging to subfamilies Clytrinae, Cryptocephalinae and Criocerinae have been described and their taxonomic significance at different levels have been discussed.

INTRODUCTION

The information on the internal reproductive organs of family Chrysomelidae is rather limited and complete systems of only a few representatives from different subfamilies have been studied (Spett & Lewitt, 1925 & 1928; Donia, 1954). The structure of the spermatheca and the number of ovarioles/ovary,however,have been studied in a larger number of species and their significance at the family level has been highlighted by workers like Verma (1955 a, b), Suzuki (1974 & 1975) and Suzuki & Yamada (1976). In the light of meagre knowledge on these organs, the authors made detailed studies on 130 species from 9 subfamilies of family Chrysomelidae. The structure of these organs in 96 species belonging to subfamilies Alticinae and Galerucinae (Pajni *et el*, 1983 a) and subfamilies Cassidinae, Hispinae, Chrysomelinae and Eumolpinae (Pajni *et el*, 1983 b) have already been described. The present report deals with male and female reproductive systems in 34 representatives of subfamilies Clytrinae, Cryptocephalinae and Criocerinae.

Apart from the general remarks by Spett & Lewitt (1925), there is hardly any report on the structure of reproductive organs of Clytrinae and Cryp-

tocephalinae. However, a few representatives of the subfamily Criocerinae have been studied for the purpose. Gupta & Riley (1967) made observations on female reproductive system and the histology of ovariole of *Crioceris asparagi* L. Wellso & Stanley (1972) described the development of reproductive organs in the two sexes of *Oulema melanopus*. The female reproductive organs of several species of *Lema* have been described by Mann & Singh (1979).

The present study includes the structure of male reproductive system in 12, 6 and 13 species and female reproductive system in 5, 6 and 4 species of subfamilies Clytrinae, Cryptocephalinae and Criocerinae respectively.

The beetles for the present work have been collected from grass, forest trees and crops through hand picking or by sweeping, between March and October during 1977–1980 The identification of the beetles has been established with the help of available literature and as a result of their comparison with identified collection in the Museums of F.R.I., Dehradun; I.A.R.I., New Delhi and Z.S.I., Calcutta.

OBSERVATIONS

1. SUBFAMILY CLYTRINAE

A. General structure and discussion of the male reproductive organs (Figs. 1–12).

The male reproductive organs in the subfamily Clytrinae have been studied in twelve species belonging to six genera. It is noticed that there occurs always a pair of rounded or oval testes and a pair of accessory glands which are short and more or less broad and lie at the proximal end of vasa deferentia closely applied to the base of the respective testis. The vasa deferentia are extremely short particularly in relation to the extremely long ejaculatory duct. Whereas the above mentioned common pattern runs through all the genera of the subfamily, the individual species under individual genera can be separated from the relative length of vasa deferentia, ejaculatory duct and the shape of accessory gland and the testis. The over all picture of the reproductive organs in the subfamily as a whole is rather constant, with minor variations in different genera and species.

General remarks by Spett & Lewitt (1925) also mention the characteristic features described above but these authors have failed to observe the presence of accessory glands in the species studied by them.

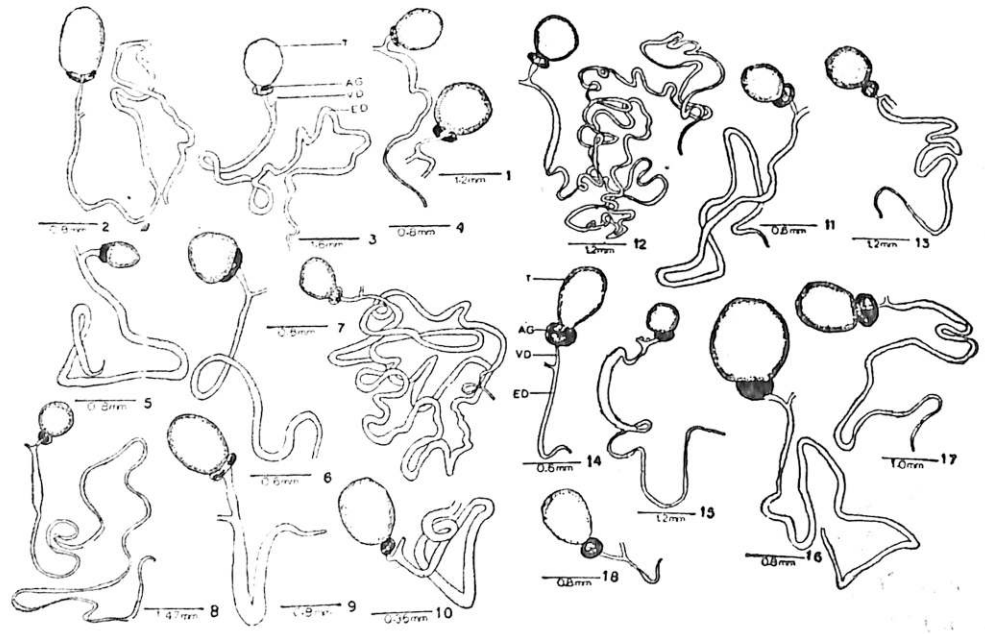
B. General structure and discussion of the female reproductive organs (Figs. 32–37).

The female reproductive organs of the subfamily Clytrinae, studied in the 5 species from genera *Gynandrophthalma*, *Diapromorpha*, *Miopristis* and *Clytra*

reveal the presence of prominent ovaries with 6–15 ovarioles in each ovary, C–shaped spermatheca, club shaped spermathecal gland, short common oviduct and the absence of bursa copulatrix. The lateral oviducts are quite variable being much longer in *Miopristis bimaculata* Jac. and quite shorter in *Clytra cardoni* Jac., *Gynandrophthalma frontalis* Jac. and *Gynandrophthalma nilgiriensis* Jac. and of a medium length in *Diapromorpha turcica* Fabr. Likewise, the length of the spermathecal duct also shows much variation. The two congeneric species under genus *Gynandrophthalma* show a closer similarity in their reproductive parts as expected. On the whole the reproductive organs of this subfamily do not confirm to any particular pattern and are infact far more discriminatory as compared to their male reproductive organs. Spett & Lewitt (1925) while making only comments of general nature on other parts of the system in this subfamily report the number of ovarioles/ovary to vary from 11–14 which falls in the broader range of 6–15 noted in this study.

2. SUBFAMILY CRYPTOCEPHALINAE

A. General structure and discussion of the male reproductive organs (Figs. 13–18)



Figs. 1–18. Male reproductive system. **1.** *Diapromorpha turcica* Fabr. **2** *Diapromorpha melanopus* Lacord **3.** *Diapromorpha* sp. **4.** *Aethomorpha nigropicta* Jac. **5** *Aethomorpha* sp **6.** *Aethomorpha militaensis* Jac. **7.** *Aethomorpha coorgensis* Bryant. **8.** *Miopristis bimaculata* Jac **9** *Cytrasoma plagiata* Duv. **10.** *Gynandrophthalma nilgiriensis* Jac. **11.** *Gynandrophthalma frontalis* Jac. **12** *Miochira lefevrei* Jac. **13** *Cryptocephalus sexsignatus* Fabr. **14.** *Cryptocephalus vahli* Fabr. **15.** *Cryptocephalus triangularis* Hope **16.** *Cryptocephalus oppositus* Jac. **17.** *Cryptocephalus analis* Oliver **18.** *Cryptocephalus* sp.

All the six species studied under the subfamily Cryptocephalinae belong to genus *Cryptocephalus*. Surprisingly, the general structure of reproductive organs is closely similar to what has been described under the subfamily Clytrinae in respect of almost all the structures. Equally surprising are, however, the variations met within different species of the genus. The variations relate to the shape and size of accessory gland but more to the length of the ejaculatory duct. For example, the ejaculatory duct in the *Cryptocephalus* sp. is about as long as the vas deferens in the species like *Cryptocephalus analis*, *c oppositus*, *C. sexsignatus*, and *C triangularis*. The ejaculatory duct of *C. vahli* shows a moderate length between the two extremes described above.

There is no other report on the male reproductive organs of the subfamily Cryptocephalinae except the description of these organs in one species studied by Spett & Lewitt (1925). They also described similar types of male reproductive organs in this subfamily.

B. General structure and discussion of the female reproductive organs (Figs. 38–43),

The six species of the genus *Cryptocephalus* studied under this subfamily show a broad similarity in their female reproductive organs with those of the subfamily Clytrinae not only the shape of the spermatheca and spermathecal gland are almost similar but also the range of the ovariole number/ovary is likewise low ranging from 8–10. In this subfamily, however, the individual species of the genus *Cryptocephalus* show significant differences in the female reproducitve system. The differences in the length of the spermathecal duct and in the development of bursa copulatrix are worthy of note.

A C-shaped spermatheca, similar to the one found in the above mentioned species, has also been reported by Spett & Lewitt (1925) and Verma (1955a) in a few species studied by them. Similarly, as against a range of 8–10 ovarioles/ovary noted by the authors, different ranges of 5–14 and 7–8 have been described by Robertson (1961) and Suzuki (1974).

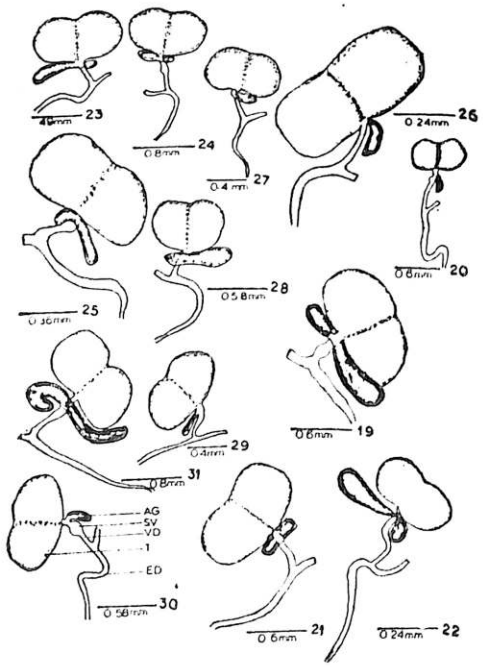
It has been stressed under the description of both male reproductive system and female reproductive system that the reproductive organs of the subfamily Cryptocephalinae show a close resemblance with those of the subfamily Clytrinae The close similarity between the male and female reproductive organs of the subfamilies Clytrinae and Cryptocephalinae noted above is also witnessed in the structure of the external male genitalia (Powell, 1941; Pajni & Bansal, 1979) and external female genitalia (Verma, 1955 b; Bansal, 1973).

3. SUBFAMILY CRIOCERINAE

A. General structure and discussion of the male reproductive organs (Figs. 19–31)

Only two genera have been studied from the subfamily Criocerinae, one of which viz , *Lema*. is represented by 12 species, while the other *i. e. Crioceris* by a single species. The general structure of the male reproductive organs is very constantly similar in all the species and is chracterized by a pair of pear-shaped testes, a pair of wide and short vasa deferentia and a pair of single or bi-lobed accessory glands opening at the bases of vasa deferentia The ejaculatory duct is of moderate length. The genus *Crioceris* can be separated on the bases of almost equal length of the lobes of accessory gland and its opening into the vasa deferentia located slightly away from the base. The dorsal notch of the testis is also more prominent as compared to the testicular notch in the genus *Lema*. All the species of *Lema* show a close resemblance in the reproductive organs and the minor variations recorded in different species relate to the condition of the single or bilobed accessory gland and their length. The very close agreement in the structure of reproductive organs in different species of *Lema* clearly support the compact nature of this genus and explains the inclusion of 116 species under this large genus by Jacoby (1908) inspite of the noted differences and the subdivision of *Lema* into many sections.

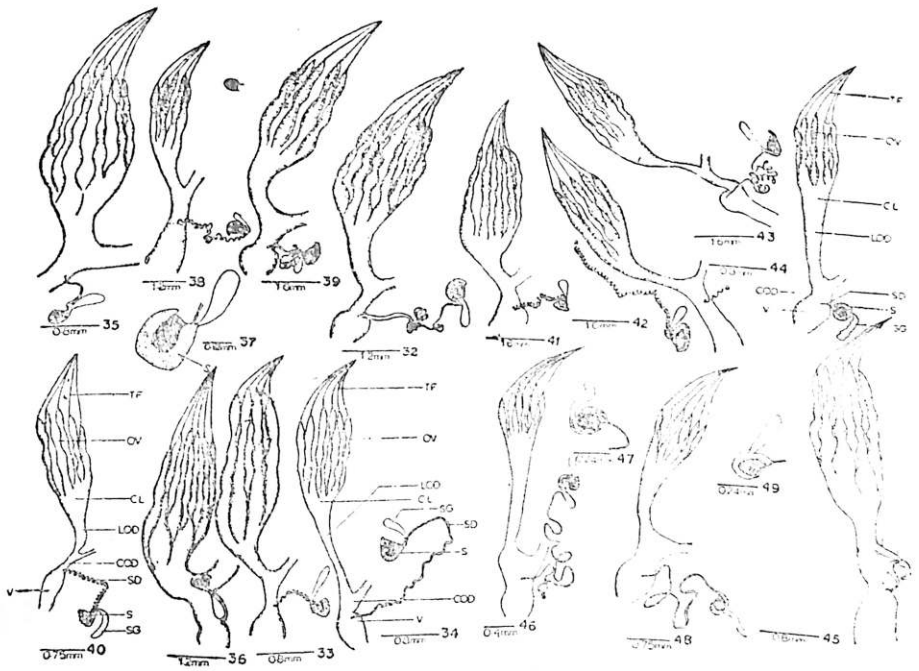
An allocation of the studied species into groups according to the sections proposed by Jacoby (1908), does not show any definite structural differences and



Figs. 19–31 Male reproductive system **19.** *Lema rufo-testacea* Clark. **20.** *Lema nigro-frontalis* Clark. **21** *Lema singularis* Jac **22.** *Lema cerea* Jac **23** *Lema suturella* Baly **24.** *Lema semifulva* Jac **25** *Lema globicollis* Baly **26.** *Lema terminata* Lacord. **27.** *Lema lacordairei* Baly **28.** *Lema* sp. I **29** *Lema* sp II **30.** *Lema* sp. III **31.** *Crioceris impressa* Fabr.

infact some of his sections appear to be unnecessary. However, the variations recorded in the male genitalia of congeneric species under *Lema* by Pajni & Bansal (1979) and a notable change in the diploid number of chromosomes in many species studied by Yadav (1974), Saha & Manna (1971), Sood (1978) alongwith the morphological differences pointed out by Jacoby (1908) and anatomical dissimilarities noted by the authors in several species might ultimately be used in splitting of this genus.

Spett & Lewitt (1925) have described two pairs of accessory glands in the species studied by them which appears to be a misinterpretation of the bilobed accessory gland. It should be noted that each bilobed accessory gland noticed in several species opens through a single aperture and two lobes thus belong to a common gland. These authors have also considered the subfamily Criocerinae



Figs. 32–49. Female reproductive system. 32. *Diapromorpha turcica* Fabr. 33. *Clytra cardoni* Jac. 34. *Miopristis bimaculata* Jac. 35. *Gynandrophthalma frontalis* Jac. 36. *Gynandrophthalma nilgiriensis* Jac. 37 Spermatheca of *G. nilgiriensis*. 38. *Cryptocephalus opositus* Jac. 39. *Cryptocephalus triangularis* Hope. 40. *Cryptocephalus hampsoni* Jac. 41. *Cryptocephalus* sp. I 42. *Cryptocephalus analis* Oliver. 43. *Cryptocephalus sexsignatus* Fabr. 44. *Lema terminata* Lacord. 45. *Lema globicollis* Baly. 46 *Lema nigrofrontalis* Clark. 47. Spermathecal complex of *L. nigrofrontalis*. 48. *Lema* sp III 49. Spermathecal complex of *Lema* sp. III.

ABBREVIATIONS USED : AG–accessory gland; CL–calyx; COD–common oviduct; ED–ejaculatory duct; LOD–lateral oviduct; OV–ovary; S–spermatheca; SD–spermathecal duct; SG–spermathecal gland; SV–seminal vesicle; T–testis; TF–terminal filament; V–vagina; VD–vas deferens.

to fall close to subfamily Donacinae on the basis of their internal reproductive organs. The authors have not studied any representative of Donacinae and is therefore, unable to comment on this relationship. Likewise, the close similarity between Criocerinae and Sagarinae emphasized by Verma (1955 b) on the bas s of external male genitalia has been refuted by Pajni & Bansal (1979) in the light of appreciable variability recorded in the structure of the male genitalia in different species o f *Lema*.

B. General structure and discussion of the female reproductive organs (Figs 44–49)

The characteristic features of the female reproductive organs, as studied in four species of genus *Lema*, include rather small ovaries with a few ovarioles each, relatively very long lateral oviducts and short common oviducts and vaginae. The spermatheca is characteristically ring–shaped and is associated with a short club–shaped spermatheca l gland that opens in the middle of the spermatheca. Whereas the general structure is similar in all four species, two of them *viz.* *Lema* sp. III and *Lema nigrofi ontalis* have a very long spermathecal duct while the other two *viz.* *L. te minata* and *L globicollis* have comparatively much shorter spermathecal duct. These differences are, however, not reflected in the male reproductive organs in the three of these four species studied for the purpose.

A more or less similar type of female reproductive system particularly the ring–shaped spermatheca has been recently described in six species of genus *Lema* by Mann & Singh (1979). Their record of 7–9 ovarioles/ovary also almost agrees with 7–10 ovarioles/ovary recorded here Likewise, the femal reproductive organs of *Crioceris asparagi* (Gupta & Riley, 1967) show a close similarity with those of genus *Lema*, although the number of ovarioles/ovary in this case varies from 11–13. Quite a different type of reproductive system is, however, met with in *Oulema melanopus* (Wellso & Stanley, 1972) in which the spermatheca is coma–shaped and receives the spermathecal gland at its proximal broader end. However, the range of 6–8 ovarioles/ovary in this species as well as in the other studied species falls well within the general range of 6–14 known for this subfamily (Robertson, 1961; Suzuki, 1974 & 1975)

The reproductive organs of Criocerinae include several special features which are not shared by any other subfamily These include bilobed testis, short ejaculatory duct, short and tubular accessory glands, ring shaped spermatheca and club shaped spermathecal gland opening in the middle of the spermatheca

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