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THE LAND SNAILS OF SHARAVATHI WILDLIFE SANCTUARY

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INTRODUCTION

Leaf litter and soil of tropical rain forests have the earth's most diverse and endangered, yet least understood communities (Emberton *et al.*, 1996). Molluscs are an important constituent of this ecosystem, yet majority of them remain undiscovered and under described, partly because of insufficient exploration and partly because of their often minute sizes (Emberton, 1995). In India, especially from the Western Ghats in Karnataka, land snails have been least worked out. The present report is from our collection from the Sharavathi Wildlife Sanctuary (14°N & 74°24' E) with a total area of 431.23 sq. km, which includes the reservoir area (123.63 sq. km.). The sanctuary was declared vide notification No. AFD. 70. FWL–71, in 1972 by the Govt. of Karnataka. The collection includes 22 examples 10 of which have been identified to the species level with the remaining been assigned to their generic name. The system of Classification followed is that given in "A Classification of Living Mollusca" (Vaught, 1989). The study assumes significance because of 10 out of the 23 families of land snails found in the Western Ghats (Madhyastha 2002) are present in this Sanctuary.

Descriptions of ten of them identified at species level have been given below.

Key to the Families

1. Shells with operculum 2
— Shells without operculum 3
2. Shells depressed, widely umbilicate ..... *Cyclophoridae*
— Shells elongate/cylindrical, narrowly umbilicate ..... *Diplommatinidae*

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3. Shells with dentition in the aperture ..... *Streptaxidae*

— Shells without dentition in the aperture 4

4. Shells longer than broad, imperforate ..... *Succineidae*

— Shells broader than higher, perforate (*Mariaella* has plate like internal shell) .....
..... *Ariophantidae*

SYSTEMATIC ACCOUNT

Order MESOGASTROPODA

Family CYCLOPHORIDAE

Genus ***Cyclophorus*** Montfort, 1810

Cyclophorus altivagus (Benson, 1854)

1854. *Cyclophorus altivagus* Benson, *A. M. N. H.* ser. 2, xiv : 411.

1914. *Cyclophorus altivagus* : Gude, *Fauna Brit. India*, Mollusca III : 56.

Shell globose, sturdy, opaque, widely umbilicate, spire short, dark brownish, with distinct chestnut flame like streaks near the sutures, and with distinct spiral lirations criss crossed by transverse striations. Body whorl with an indistinct keel, with 3–5 lirations above the keel prominent. Whorls 5, rapidly increasing, with visible growth lines, sutures distinct. Apex prominent, chestnut coloured with the periostracum generally corroded. Aperture rounded, lips double, inner lip slightly protruded, continuous forming a thick callus on the columellar margin. Outer lip, expanded and reflected, discontinuous at the point of attachment to the penultimate whorl. Operculum concentric, concave, retractable only up to the aperture.

Measurements : H = 32 mm, W = 36 mm.

Material observed : Six examples. Nidagod about 25 kms from Sagar, 29-7-2003 (Coll. Rajendra G. M.).

Distribution : Maharashtra : Mahableshwar, Karnataka : Sharavathi Valley (new record).

Remarks : This species has been reported earlier from Maharashtra only. This report marks the extension of the range of distribution. It measures a bit more than the measurements given in the *Fauna of British India* (Gude, 1921). The absence of any sinus in the columellar lip rules out the possibility of it being *C. indicus.*

Genus ***Alycaeus*** Gray, 1850

Alycaeus expatriatus (Blanford, 1860)

1860. *Alycaeus expatriatus* Blanford, *J. A. S. B.* xxix, p. 123;

1914. *Alycaeus expatriatus* : Gude, *Fauna Brit. India*, Mollusca III : 249.

Shell globose, widely umbilicate, uniformly pink coloured, apex reddish, an accessory canal runs along the suture at the body whorl. Shell thin with distinct vertical striations, which are lacking near the aperture. Whorls 3½, body whorl much inflated, just before the constriction, after which it descends considerably towards the aperture forming a vertical keel like swelling. Sutural tube present just before the constriction. Body whorl near the aperture descending and rounded. Lips double, outer expanded, inner lip continuous. Operculum thin, concave, retracts completely up to the constriction.

Measurements : H = 3 mm, W = 4 mm.

Material observed : Six examples, Mundgesara, around 6 kms from Sagar. 29-7-2003 (Coll. Rajendra G. M.)

Distribution : Tamil Nadu : Neddoowutton Ghat, Nilgiris, Annamalai hills, Shevroy hills, Karnataka : South Canara, Sagar.

Remarks : This is an interesting genus, which is widely distributed in the north eastern Himalayas with only two species reported in South India. The keel after the constriction is not so thoroughly marked and also the sutural tube is considerably long which is the opposite in *A. footei*, the other species found in South India.

Family DIPLOMMATINIDAE

Genus *Nicida* Blanford, 1868

Nicida liricincta (Blanford, 1868)

1868. *Diplommatina (Nicida) liricincta* Blanford, *Journ. Conchyl.* xvi : 336, pl. 14, fig. 5.
1914. *Nicida liricincta* : Gude, *Fauna Brit. India,* Mollusca III : 293.

Shell ovate, imperforate, glossy, thin and translucent. Spire elevated, apex obtuse, sutures impressed. Whorls 5½, distinctly sculptured with 2 spiral lirations on third, fourth and 3 on the penultimate whorls, body whorl with 4–5 lirations. The penultimate whorl is the largest, body whorl slightly constricted. Aperture rounded slightly ascending touches nearly half of the penultimate whorl. Lips double, outer lip slightly reflected, Operculum thin, fully retractable much beyond the aperture.

Measurements : H = 3 mm, W = 1.5 mm.

Material observed : Ten examples, Jog about 29 kms from Sagar. 28-7-2003 (Coll. Rajendra G. M.).

Distribution : Maharashtra : Khandalla, Karnataka : Jog Falls (new report).

Remarks : This is a widely distributed genus endemic to Sri Lanka and South India. The present is the first report of the species outside Khandalla.

Genus ***Opisthostoma*** Blanford, 1861

Opisthostoma fairbanki (Blanford, 1875)

1866. *Opisthostoma fairbanki* Blanford, *Proc. Zool. Soc.* : 448, pl. 38, figs. 14.

1914. *Opisthostoma fairbanki* : Gude, *Fauna Brit. India,* Mollusca III : 298.

Shell cylindrical, narrowly perforate, glossy, thin and translucent. Spire sunken, apex obtuse, sutures impressed. Whorls 5, apical two gradually increasing and sunken, third suddenly increases almost enclosing the former, the penultimate whorl is equal to the third, body whorl constricted and deflected inwards. Whorls sculptured with vertical lirations, which are prominent on the body whorl. Aperture reversed, triangularly rounded, slightly ascending touches nearly half of the penultimate whorl. Lips double, reflected, with a broad channel between them. Operculum thin, fully retractable much beyond the aperture.

Measurements : H = 1.5 mm, W = 1.5 mm.

Material observed : Four examples, about 15 kms from Sagar. 28-7-2003 (Coll. Rajendra G. M.).

Distribution : Maharashtra : Khandalla, Karnataka : Sagar (new record).

Remarks : This remarkable micro gastropod species measures around 1.5 mm. When observed under the microscope it exhibits a distinct sculpture, with its unique contorted aperture. Collection of leaf litter is the only feasible method of collecting this species.

Order STYLOMMATOPHORA

Family ARIOPHANTIDAE

Genus ***Ariophanta*** Desmoulins, 1829

Ariophanta canarica (Blanford, 1901)

1901. *Ariophanta canarica* Blanford, *Proc. Mal. Soc.* iv : 248, pl. 25, fig. 1.

1908. *Ariophanta canarica* : Blanford & Godwin-Austen, *Fauna Brit. India,* Mollusca I : 32.

Shell sinistral, moderately umbilicate, sturdy, with hay yellow periostracum, underneath white. Spire elevated, apex obtuse, whorls rapidly increasing, and sutures prominent. Whorls 5, surface with coarse transverse striations, with distinct lines of growth, body whorl distinctly angulate, which takes the appearance of a keel in younger forms. Aperture descending sharply just below the keel for a short distance, lunately rounded, lips slightly thickened. Umbilicus moderate, almost covered by the triangularly reflected columellar lip.

Measurements : H = 30 mm, W = 32 mm.

Material observed : Eight examples, Kabdur about 32 kms from Sagar. 28-7-2003 (Coll. Rajendra G. M.).

Distribution : Karnataka : South Canara, Kabdur (Sagar).

Remarks : This species is endemic to Western Ghats and is easily distinguishable from *A. bajadera* and *A. intumescens* by its descending body whorl and also being comparatively more solid and sturdy.

Ariophanta immerita (Blanford, 1870)

1870. *Nanina-Ariophanta* Blanford, *J.A.S.B.* xxxix : 17.

1908. *Ariophanta immerita* : Blanford & Godwin-Austen, *Fauna Brit. India,* Mollusca I : 31.

Shell sinistral, moderately umbilicate, thin, fragile, translucent. Spire moderate, apex obtuse, dark brown above with a whitish band at the periphery after which the colour fades into white nearing the umbilicus, whorls rapidly increasing, and sutures not impressed. Whorls 5, surface with smooth transverse striations, converging with lines of growth, body whorl distinctly angled, rounded nearing the aperture in mature forms; it takes the appearance of a keel in younger forms. Body whorl near the aperture scarcely descending, with nacre just behind the slight pinkish aperture, lips slightly thickened. Upper lip flattened, basal lip inflated and rounded, columellar lip triangularly reflected, but does not cover the comparatively wider umbilicus.

Measurements : H = 32 mm, W = 38 mm.

Material observed : Six examples, about 18 kms from Sagar. 28-7-2003. (Coll. Rajendra G. M.).

Distribution : Karnataka : South Canara, Sagar.

Remarks : This typical species is endemic to Western Ghats. It is quite commonly distributed in Karnataka. It has a marked resemblance to *A. cysis* from which it differs in size, colour pattern and deeper umbilicus. In *A. cysis* the upper lip is rounded whereas in this species it is flattened.

Genus ***Cryptozona*** Morch, 1872

Cryptozona solata (Benson, 1848)

1848. *Helix* Benson, *A. M. N. H.* (2) ii : 159.

1908. *Ariophanta* solata : Blanford & Godwin-Austen, *Fauna Brit. India,* Mollusca I, p. 31.

Shell dextral, moderately umbilicate and translucent. Spire moderate, apex obtuse, pinkish turning to white as the shell grows. Shell with small specks all over the body whorl; with a chestnut coloured band at the periphery, coinciding with the sutures and another just below it visible only on the body whorl, both the bands end abruptly just behind the aperture. Whorls 5½, rapidly increasing, sutures impressed, surface with smooth transverse striations, body whorl, rounded. Aperture negligibly descending, lips thin, white but just behind, it is hay coloured, inside it has nacre.

Upper lip flattened, basal lip inflated and rounded, columellar lip triangularly reflected, partly covering the umbilicus.

Measurements : H = 16 mm, W = 26 mm.

Material observed : Six examples, about 18 kms from Sagar. 28-7-2003. (Coll. Rajendra G. M.)

Distribution : Tamil Nadu : Nilgiris. Karnataka : Sagar (new report).

Remarks : This genus was earlier grouped with *Ariophanta*; it can be easily distinguished from other members of the genus by its whitish shell and the translucent spots.

Genus ***Mariaella*** Gray, 1855

Mariaella dussumieri (Gray, 1855)

1855. *Mariaella dussumieri* Gray, *Cat. Pulm. B. M.* : 63.

1908. *Mariaella dussumieri* : Blanford & Godwin-Austen, *Fauna Brit. India*, Mollusca I : 205, fig. 71.

Shell internal, flat, solid in mature forms, with beak like apex, sides sharp, hay yellow in colour, spire indistinct. Animal is a slug; yellowish with dark brown spots present in the hind region in older forms, the spots are not distinct in the younger. Shell is internal, partly visible externally through the pore present on the top of the mantle. Mantle lobes united to form a shield enclosing the various systems, on the surface with two ridges running almost parallel to each other, the right one from the respiratory orifice to the shell aperture the other round the left margin. Posterior portion sharply keeled behind the mantle, ending in the mucus pore. Foot tripartite, edges with short vertical black parallel lines.

Measurements : Animal at full stretch 46 mm.

Material observed : Ten examples, about 32 kms from Sagar. 28-7-2003 (Coll. Rajendra G. M.)

Distribution : Sri Lanka and Western Ghats up to Mahableshwar, Karnataka : Sagar.

Remarks : This endemic slug of Western Ghats and Sri Lanka is an agricultural pest. Farmers cultivating *Vanilla*, the widely used flavouring agent, reported that it is a voracious feeder of the leaves. At full stretch the specimen measured around 46 mm.

Family STREPTAXIDAE

Genus ***Streptaxis*** Gray, 1837

Streptaxis canaricus (Blanford, 1869)

1869. *Streptaxis canaricus*, Blanford. (Beddome M. S.) *J.A.S.B.*, xxxviii, pt. 2 : 142, pl. 16, fig. 11.

1908. *Streptaxis canaricus* : Blanford & Godwin-Austen, *Fauna Brit. India*, Mollusca I : 15, fig. 9.

Shell dextral, moderately umbilicate, and white in colour, thick and sturdy. Spire short, apex obtuse. Whorls 5½ nearly flat, rapidly increasing, sutures impressed, surface with transverse lirations. Penultimate whorl sharply keeled projecting more than the body whorl, which is slightly diverging from the columellar axis and flattened below. Aperture axe shaped, with indentations present behind the peristome, which is reflected, lips thin. Aperture with a deeply re entering parietal lamella and 6 palatal teeth, two basal, two columellar and two on the right margin. Umbilicus shallow.

Measurements : Shell damaged.

Material observed : A single example at Markuttuka about 36 kms from Sagar, 29-7-2003 (Coll. Rajendra G. M.).

Distribution : Karnataka : South Canara, Sagar (Markuttuka).

Remarks : This remarkable specimen is one of the few-keeled species of *Streptaxis*. It is clearly distinguishable by its beautiful coarse sculpture and numerous indentations present in the aperture. Found very rarely.

Family SUCCINEIDAE

Genus ***Succinea*** Draparnaud, 1801

Succinea raoi Subba Rao & Mitra

Succinea arboricola Rao, *Rec. Indian Mus.*, **27** : 394, figs 7-11. (Preoccupied by *Succinea arboricola* Connolly).
Succinea raoi Subba Rao & Mitra, *Nautilus*, **90**(3) : 125.

Shell dextral, imperforate, glossy upon cleaning the black deposition on the surface, hay coloured, thin and delicate. Spire short, apex obtuse. Whorls 3, rounded, rapidly increasing, sutures shallow, surface with transverse striations converging with the lines of growth and decussated by faint spiral striations. The body whorl is disproportionately large. Aperture more than double the spire, lips thin, columella chestnut coloured.

Measurements : H = 3 mm, W = 2.5 mm.

Materials observed : Four examples from Kathlekan, about 35 kms from Jog Falls. 29-7-2003 (Coll. Rajendra G. M.).

Distribution : Maharashtra : Khandalla, Pune; Karnataka : Kathlekan (new report).

Remarks : This species though not described in the *Fauna of British India* (Gude, 1914), was identified, by matching the specimens present in the ZSI collections. True to the amphibious nature of the genus, this species has been found in a very threatened micro habitat the Myristica swamps. They were found attached to wild Arecanut trees, with black depositions over the shell camouflaging it.

SUMMARY

This study is the first of its kind on land snails of this picturesque Wildlife Reserve. The land snails of Western Ghats show high endemism; 94% including those common with Sri Lanka (Ramakrishna & Mitra 2002, Mavinkurve *et al.*, 2003). The present study is in tune, with all the species studied being endemic to the Western Ghats and Sri Lanka ranges. Among these, *Mariaella dussumieri* is a serious pest causing damage to the economically important Vanilla plants. It is common in Home Gardens, near water pipes, and wherever there is even slight amount of moisture. *Ariophanta canarica, A. immerita* and *Streptaxis canarica* have earlier been reported from South Canara only, this study marks an extension of their range up north. *Succinea arboricola* has been reported way back in 1979 by N. V. Subba Rao and Mitra in their checklist of Molluscs of Pune. It is also found in Sharavathi valley.

The report of *Cyclophorus altivagus* and *Nicida liricincta* marks the southern most range for the species while that of *Alycaeus expatriatus* extends its distribution up north.

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REFERENCES

Blanford, W. T., and Godwin-Austen, H. H. 1908. *Fauna of British India.* Mollusca, Testacellidae and Zonitidae : 1-303.

Emberton, K. C. 1995. Land snail community morphologies of the highest diversity sites of Madagascar, North America, and New Zealand, with recommended alternatives to height-diameter plots. *Malacologia*, **36** : 43-66.

Emberton, K. C., Pearce, T. A. and Randalana, R. 1996. Quantitatively Sampling land-snail species richness in Madagascan rainforests. *Malacologia*, **38**(1-2) : 203-212.

Gude, G. K. 1914. *Fauna of British India.* Mollusca Vol. II. Trochormorhidae–Janellidae : 1-501.

Gude, G. K. 1921. *Fauna of British India.* Mollusca Vol. III. Land operculates : 1-370.

Madhyastha, N. A., Mavinkurve, R. G. and Sandhya, P. S. 2003. Land snails of Western Ghats. In ENVIS Bulletien : Wildlife & Protected Areas. Conservation of Rain forests in India, A. K. Gupta, Ajith Kumar and V. Ramakantha (ed.), Vol. 4, No. 1, 143-152.

Mavinkurve, R. G., Sandhya, P. S. and Madhyastha, N. A. 2003. Invertebrates as the new frontier area in Conservation Planning, Mollusca : A case study. *Environ* Abstract/Souvenir National Seminar on 'Ecorestoration, Biodiversity Conservation & Sustainable Development' Pp. 13.

Ramakrishna and Mitra, S. C. 2002. Endemic Land molluscs of India. *Rec. zool. Surv. India, Occ. Paper* No. **196** : 1-65 (Published : Director, Zool. Surv. India, Kolkatta).

Subba Rao, N. V. and Mitra, S. C. 1979. On the land and freshwater molluscs of Pune district, Maharashtra. *Rec. zool. Surv. India.* **75** : 1-37.

Vaught, K. C. 1989. *A Classification of the living Mollusca.* (Eds. R. T. Abbott and K. J. Boss). American Malacologists, Melbourne, Florida 32902, USA.