distinguishable from that of *C. pseudo-olitorius* and other species of this genus by the presence of longitudinal ridges and furrows, while *C. pseudo-olitorius* Islam and Zaid does not exhibit such features. A short description of collected species[1,3] (both living and dried plants), *C. pseudo-olitorius* Islam and Zaid is presented below (Figures 1 and 2).

C. pseudo-olitorius Islam and Zaid in *Biologia, Lahore*, 1969, **6**, 174; Edmonds in *Herbarium Survey of African Corchorus species*; 1990, **35**, 80.

An annual erect herb, 25 to 80 cm tall, unbranched or scarcely branched; stem cylindric, glabrous; leaves oblong, oblong lanceolate, 3–4.3 × 0.8–1.2 cm, acute, serrate, cuneate, usually with a pair of basal setae, 1–2 mm long; petioles slender, 5–7 mm long, glabrous; stipules subulate, 1–2 mm long; flowers axillary, usually solitary or 2–3 in cluster; sepals 5, linear oblong, about 4 mm long, finely ciliate along margin, torulose; petals 5, obovate, 4–5 mm long, ciliate at base; stamens many, about 20; ovary linear, 2–2.5 mm long, setulose; capsules cylindric, 2–3 cm long, setulose, straight or slightly curved, splitting into 3 valves, tapering into a short apical beak; seeds many, angular, verrucose; brownish black.

The plant grows on somewhat black soil on the raised boundary of a rice field. Dried plants are also found as weeds in sugarcane fields along with other weeds dominated by grasses. It prefers wet or moist habitat condition and can survive for a longer time from April to January as a potential weed in a crop field. Flowering occurs in May to December while fruiting takes place in June to January. The voucher specimen has been deposited in the Central National Herbarium (CAL) of the Botanical Survey of India, Howrah, West Bengal.

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A. K. MAHAPATRA*,†
M. ABDUL NIZAR**
DIPANKAR SAHA*
A. SAHA*
D. GUPTA*

*Central Research Institute for Jute and Allied Fibres,
Indian Council of Agricultural Research,
Barrackpore,
Kolkata 700 120, India
**Regional Station,
National Bureau of Plant Genetic Resources,
Vellanikkara,
Thrissur, India
†For correspondence.
e-mail: crijaf@wb.nic.in

Paragonimus and paragonimiasis – A new focus in Arunachal Pradesh, India

Paragonimiasis is potentially a serious disease in many countries of the world and is caused by the lung fluke genus *Paragonimus* belonging to the family Troglotrematidae. *Paragonimus* infection in man is caused by eating of undercooked/raw, infected crabs and crayfishes, and affects at least 22 million people throughout the world[1]. The public health and economic impact of paragonimiasis is considerable, in terms of morbidity and loss of productivity. It is often misdiagnosed as tuberculosis because of overlapping clinical manifestations including chest pain, cough and haemoptysis and confusing radiological findings in chest X-rays[2]. No data are presently available on the occurrence of paragonimiasis in India except in Manipur. In Manipur human paragonimiasis is caused by *P. westermani*[3]. During our survey on food-borne trematodes, we observed the habit of eating raw and undercooked crabs among the people of Arunachal Pradesh. On enquiry from local doctors, long-term treatment failures among clinically and radiologically diagnosed tuberculosis cases were reported. This prompted us to undertake the study on paragonimiasis in the state and we detected a new focus of this disease. Considering the public health importance of paragonimiasis and also its rarity the present report has been prepared.

A community-based survey was carried out in the Changlang District of Arunachal Pradesh during May–June 2002. It was found that 95% of local inhabitants had the habit of consuming crabs and crayfishes. These crabs were eaten mostly after roasting though occa-

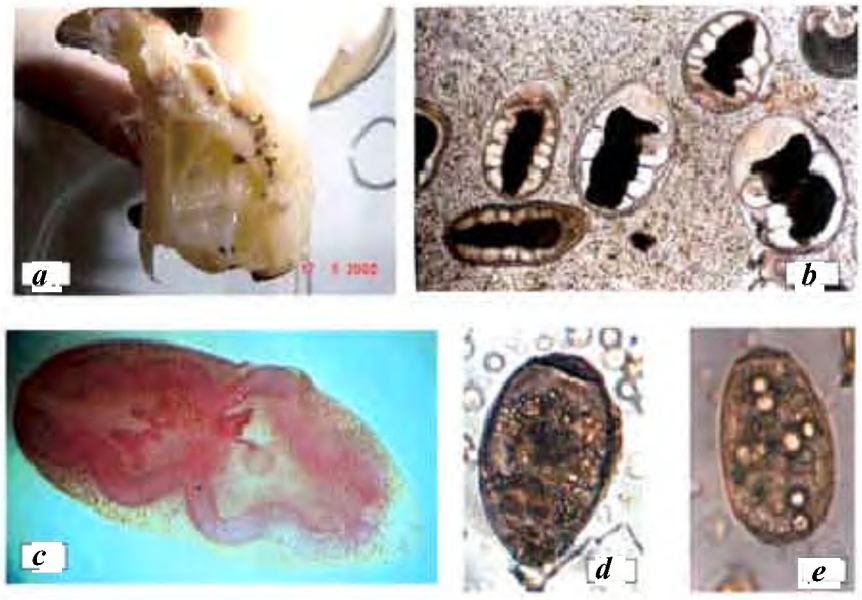

Figure 1. ***a***, Metacercariae of *Paragonimus heterotremous* encysting in the cephalothoracic muscles of fresh water crab *Barytelphusa lugubris*; ***b***, Metacercariae of *Paragonimus heterotremous* isolated from the muscles of crab host. Unstained preparation; ***c***, Adult *Paragonimus heterotremous* experimentally developed in Wistar rats; ***d***, ***e***, Eggs of *Paragonimus heterotremous*.

sionally, crabs and crayfishes were also consumed raw. An effort was made to find out the possible human infection with paragonimiasis. Stool samples from 188 individuals were collected in 10% formol saline in plastic containers from randomly selected households. Formol-ether concentration technique was used for detection of parasite eggs microscopically[4]. Seven sputum samples were also collected from clinically suspected tuberculosis patients and were examined for *Paragonimus* eggs in 3% NaOH using the concentration technique[5]. Out of 188 stool samples collected from people of the locality, two cases were found positive for the eggs of *Paragonimus*. One sputum sample, out of seven clinically suspected TB patients, was also found positive for *Paragonimus* eggs.

Freshwater crabs were also collected from a mountain stream of the area to ascertain the presence of infection in crabs. Metacercarial infection in the crab hosts was examined by compression of tissue pieces between two glass slides and by digestion technique using artificial gastric juice[1]. Nineteen out of 32 (59.4%) *Barytelphusa lugubris* crabs collected were found infected with metacercariae of *P. heterotremous* species. No metacercarial infection was detected in *Sartoriana spinigera* ($n = 50$). The *Paragonimus* metacercariae collected from infected crabs were oval and measured 654 to 750 μm in length (mean = 717 μm, SD ± 45.3 μm) and 523 to 636 μm in maximum width (mean = 591 μm, SD ± 49.2 μm). The oval-shaped metacercaria is characteristic of *P. heterotremous*[6]. The crab species *Ranguna smithiana* and *Parathelphusa dugasti* from Thailand and *Potamon smithianus*, *Sinolapotamon patellifer* and *Sinopotamon denticulatum* from China serve as natural crab hosts of *P. heterotremous*[1]. The crab species *Barytelphusa lugubris* found in Arunachal Pradesh is a new host record for *P. heterotremous*. The intensity of infection in *Barytelphusa lugubris* crabs ranged from 15 to 1000 metacercariae (mean = 165 metacercariae per infected crab). Mean intensity of *Paragonimus* metacercarial infection in female crabs was 183.3 compared to 82.5 in case of male crabs. For confirmation and species identification of *Paragonimus*, metacercariae obtained from infected crabs were developed to adult flukes in experimental Wistar rats. The adult flukes recovered were fully mature and hundreds of *Paragonimus* eggs were detected in cystic contents and the uterus of the worms. The eggs measured 57.2–91.1 μm (mean = 78.4 μm, SD = ± 7.5 μm) in length and 37.5–66.1 μm (mean = 49.2 μm, SD = ± 5.8 μm) in maximum width. The adult worms were thick bodied, elongated and reddish brown in colour, measuring 5–8.5 × 2–4.5 mm. The two testes were lobed and irregular in shape and situated side-by-side in-between the ventral sucker and the posterior end of the body. The single ovary, slightly smaller than or equal to testis in size, is located behind the ventral sucker slightly towards the left. On this basis and the morphology of the typical metacerariae[6], these lung flukes were found conspecific with *Paragonimus heterotremous*.

In India, human paragonimiasis was first described in Manipur[3] in 1982. Subsequently, 39 more cases of human paragonimiasis due to *P. westermani* were reported from Manipur[7]. So far, human infection with *P. heterotremous* is reported from South China, Laos and Thailand[8]. Infection with *P. heterotremous* in Arunachal Pradesh may be due to proximity of this region with South China from the zoogeographical point of view.

The occurrence of high infection rates in crabs with *P. heterotremous* metacercariae in Arunachal Pradesh and detection of indigenous cases of human infection indicate that paragonimiasis is endemic in this region. It is well known that in areas where both paragonimiasis and tuberculosis co-exist, diagnostic confusion can affect the control programmes of tuberculosis as well as of paragonimiasis, especially in this mountainous region. Due to public health significance of paragonimiasis, a comprehensive study is needed to throw some light on the extent and epidemiology of this disease in Arunachal Pradesh.

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KANWAR NARAIN
K. REKHA DEVI
J. MAHANTA*

Regional Medical Research Centre,
N.E. Region, Indian Council of Medical Research,
Post Box # 105,
Dibrugarh 786 001, India
**For correspondence.*
e-mail: icmrrcdi@hub.nic.in

First record of charophytes from the Permian Barakar Formation of the Talchir Gondwana Basin, Orissa

The Gondwana deposits in the Talchir Basin, Orissa are subdivided into Talchir, Karharbari, Barakar, Barren Measure and Kamthi formations in ascending order. Of these, the Barakar Formation is economically most important for its coal reserves and is the best studied. It contains about 100 m exposed sequence of alternating sand, silt, clay and coal horizons. There are four regional coal seams within this unit. The present charophytes are obtained from the calcareous siltstone beds which occur exposed between the 3rd and 4th regional coal seams in the upper part of the middle Barakar Formation near the Koshala Village, Angul District, Orissa (Figure 1).

Charophytes constitute an important fossil group in continental ecosystems and biostratigraphy. This group is least explored for palaeoenvironmental interpretations in the branches of palaeobotany and micropalaeontology. Moreover, Permian charophytes are relatively rare in the world. Thus, any new recognition in their taxonomy, especially from Permian, is very important. I report here the taxonomic recognition of two new forms (species) of charophytes from the Talchir Gondwana Basin as the first record of Permian charophytes from India and second from Gondwana. The specimens are stored in the Repository Section of the Geological Survey of India, Kolkata, India.

Order Charales Mädler, 1952, Family Porocharaceae Grambast, 1962, Subfamily Cuneatocharoideae Wang *et* Huang, 1978 (ref. 1) Genus *Paracuneatochara* Wang, 1984 (ref. 2). Type species *Paracuneatochara jinxiensis* Wang, 1984 (ref. 2). *Paracuneatochara talchirensis* sp. nov. (Figure 2 *a–f*). Etymology: The species is named after the basin from where it is recovered. Materials: Five specimens (CD/chara/1-5); CD/chara/1 is the holotype and the rest are paratypes.

The fossils are from a calcareous siltstone unit occurring between the 3rd and 4th regional coal seams (upper part of the middle Barakar Formation) exposed near Kosala village, Angul District, Orissa (Figure 1). Gyrogonites are bulbiform (650–700 µm in length and 450–600 µm in width) with sharp but small conical apex and rounded base, five sinistrally-coiled spiral cells (80 µm to 100 µm across), concave, equatorial angle usually 10° to 15°, apical pore absent, basal plate clearly divided. The generic characteristics of *Paracuneatochara*[2] such as bulbiform shape, conical apex, rounded base, five sinistrally-coiled spiral cells and low equatorial angle are observed in this form. This form possesses subtle differences in morphology from the type species *P. jinxiensis* Wang, in having less conical apex, divided basal plate and non-pyramidal but bulbiform shape. It is also

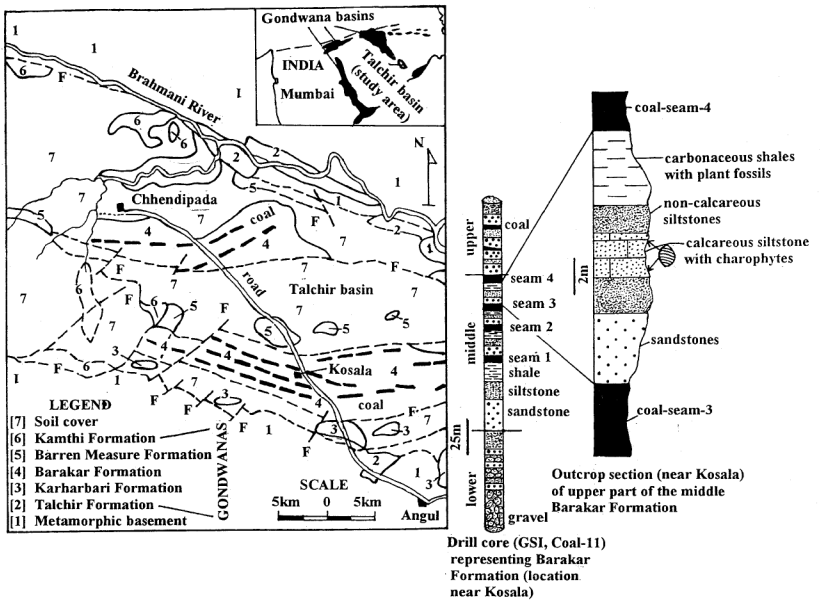

Figure 1. Geological map of a part of the Talchir Basin, Orissa showing the fossil locality and local stratigraphic section marked with the fossil beds.