Indian Journal of Parasitology, 1979, **3**(1), 5—8

(18)

NEUROSECRETORY CELLS IN *GASTROTHYLAX* SP.

VEENA MEHROTRA AND PASANG TSHERING BHUTIA

Department of Biosciences, Himachal Pradesh University, Simla—171005

(Received January 20, 1978 ; revised January 24, 1979)

SUMMARY

The neurosecretory cells of *Gastrothylax* sp. have been found to be of two distinct morphological types. Type A cells (generally round or unipolar, larger in size and with vacuolated cytoplasm) occur in the brain, nerve cord, pharynx, subtegumental and general parenchyma, and close to the uterine wall. Type B cells (round, uni-, bi-, or multipolar, smaller and with no or little vacuolization in their cytoplasm), besides their presence in these sites, are also found in the acetabulum, wall of the oesophagus and intestine, and the regions close to the lymph vessels, vitelline follicles, seminal vesicle, pars musculosa, pars prostatica and genital papilla.

INTRODUCTION

Since the demonstration of neurosecretory cells (NSC) in the cerebral ganglion of *Dicrocoelium lanceatum* by Ude (1962), these cells have been detected in many digenetic trematode parasites, namely, *Fasciola* spp. (Gresson and Threadgold, 1964 ; Grasso, 1967a, b; Shyamasundari and Hanumantha Rao, 1975), *Opisthodiscus diplodiscoides* (Matskasi, 1970), *Leucochloridiomorpha constantiae* (Harris and Cheng, 1972), *Paramphistomum epiclitum* (Mehrotra and Bhutia, 1977) and *Pleisiochorus* sp. (Hanumantha Rao and Shyamsundari, 1977). While most of these studies, and those carried out by electron microscope (Dixon and Mercer, 1965 ; Silk and Spence, 1969 ; Reisigg, 1970 ; Wilson, 1970 ; Grasso and Quaglia, 1974), revealed the presence of NSC in the brain, nerve cord and/or suckers, those on *P. epiclitum* and *Pleisiochorus* sp. showed wider distribution of these cells within the body of the parasite. The present investigation deals with the NSC in *Gastrothylax* sp.

METHODS

Adult specimens of *Gastrothylax* sp. were collected in 0.9% saline from the rumen of freshly slaughtered sheep at a local abbatoir. Within 4-5 hr after their removal from the host the worms were relaxed in hot water and fixed in Bouin and Susa for 48 hr. The fixed material was processed for sectioning and staining as mentioned elsewhere (Mehrotra and Bhutia, 1977). The measurements of the NSC were taken with the help of an occular micrometer and are in micrometres.

RESULTS

The occurrence of phloxionophilia and/or fuchsinophilia in their perikarya was taken into account to determine the neurosecretory nature of the cells. Two types of morphologically distinct NSC were recognized. Type A cells were larger in size, with vacuolated cytoplasm and generally having a single nucleolus, mostly rounded in contour, and with their distribution limited to only a few organs. Type B cells were smaller in size, with a little or no vacuolation in their perikaryotic area and with one or more nucleoli, of various shapes and relatively extensive distribution. The differences in the size of the cell body,

nucleus and nucleolus in the two types of NSC along with their distribution in the body are depicted in Tables 1 and 2.

Table 1. *Type A NSC in* Gastrothylax *sp.*

Location	Cell body	Nucleus	Nucleolus
Brain and nerve cord ..	32.2—57.5 × 18.4—32.2	11.5—13.8 × 10.3—11.5	4.6 × 3.4—4.6
Pharynx	25.3—39.1 × 20.7—23.0	9.2—13.8 × 9.2 ..	4.6 × 4.6
Subtegument ..	36.8—57.5 × 28.0—48.0	10.3—18.4 × 7.0—15.0	4.6 × 3.9—4.6
Uterine wall	30.6—49.9 × 18.4—27.6	10.3—11.5 × 8.0—11.5	2.7—4.6 × 3.0—4.6
Parenchyma ..	41.4—62.1 × 27.6 ..	10.4 —11.5 × 9.2	4.6 × 4.6

Table 2. *Type B NSC in* Gastrothylax *sp.*

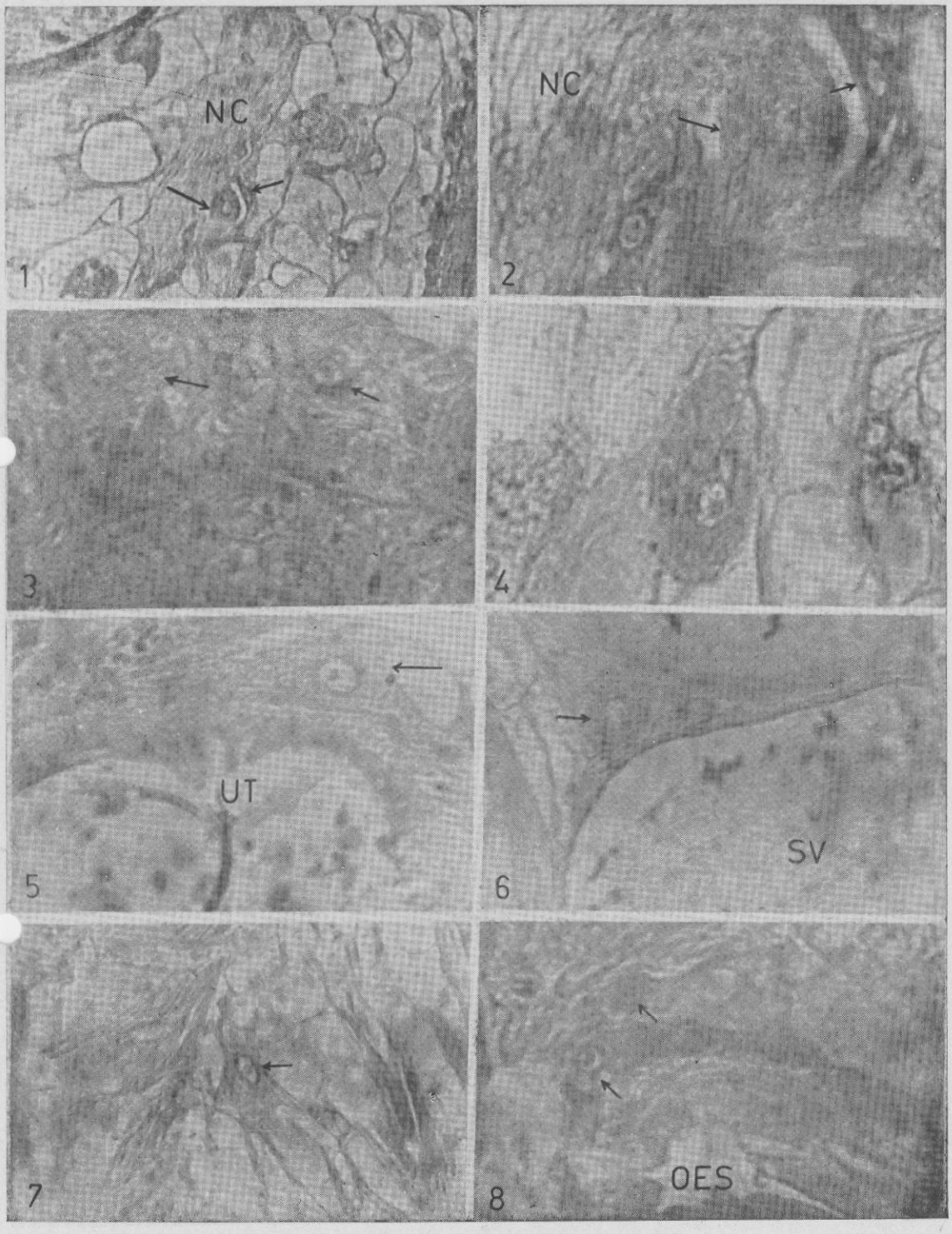
Location	Cell body	Nucleus	Nucleolus
Brain and nerve cord ..	20.7—25.3 × 9.2—11.5	10.3—11.5 × 4.6—5.7	4.6—5.7 × 3.4—4.6
Pharynx (=oral sucker) ..	13.8—29.9 × 11.5—23.0	8.5—11.5 × 6.9—9.2	2.3—4.6 × 2.3—4.6
Acetabulum	16.1—28.7 × 11.5—20.7	9.2—11.5 × 6.9—9.2	2.3—4.6 × 2.3—3.4
Subtegument	34.5—36.8 × 25.3—32.2	9.2 × 5.7—8.0	2.3—3.9 × 2.3—3.0
Parenchyma	25.3—29.9 × 24.1—26.4	6.9—10.3 × 4.6—9.2	2.3—3.4 × 2.3—3.4
Oesophagus	10.3—16.1 × 9.2—13.8	5.7—6.9 × 5.7—6.9	4.6—5.7 × 2.3—4.6
Intestinal wall ..	23.0—25.3 × 16.1—20.7	9.2—9.3 × 6.9—8.0	2.9—4.6 × 2.9—4.6
Uterine wall	23.0—34.5 × 20.7—27.6	9.2—11.6 × 5.7—11.5	2.8—4.6 × 2.9—4.6
Near vitellaria ..	28.7—34.5 × 20.7—32.2	9.2—11.5 × 6.9—8.6	4.6 × 3.9—4.6
Seminal vesicle ..	16.1—18.4 × 12.6—13.8	7.5—8.5 × 6.9	3.9 × 3.9
Lymph vessels ..	34.5—41.4 × 18.4—20.7	11.5 × 5.7—6.9	2.9—3.9 × 2.9—3.4
Pars prostatica ..	23.0—27.6 × 20.7—25.3	10.3—11.5 × 9.2	4.6 × 4.6
Genital papilla ..	29.7—34.5 × 27.6—28.7	11.5 × 10.3—11.5	4.6 × 3.9—4.6

The brain, nerve cord, pharynx, subtegumental and general parenchyma and the regions approximating the uterine coils showed the presence of both types of NSC.

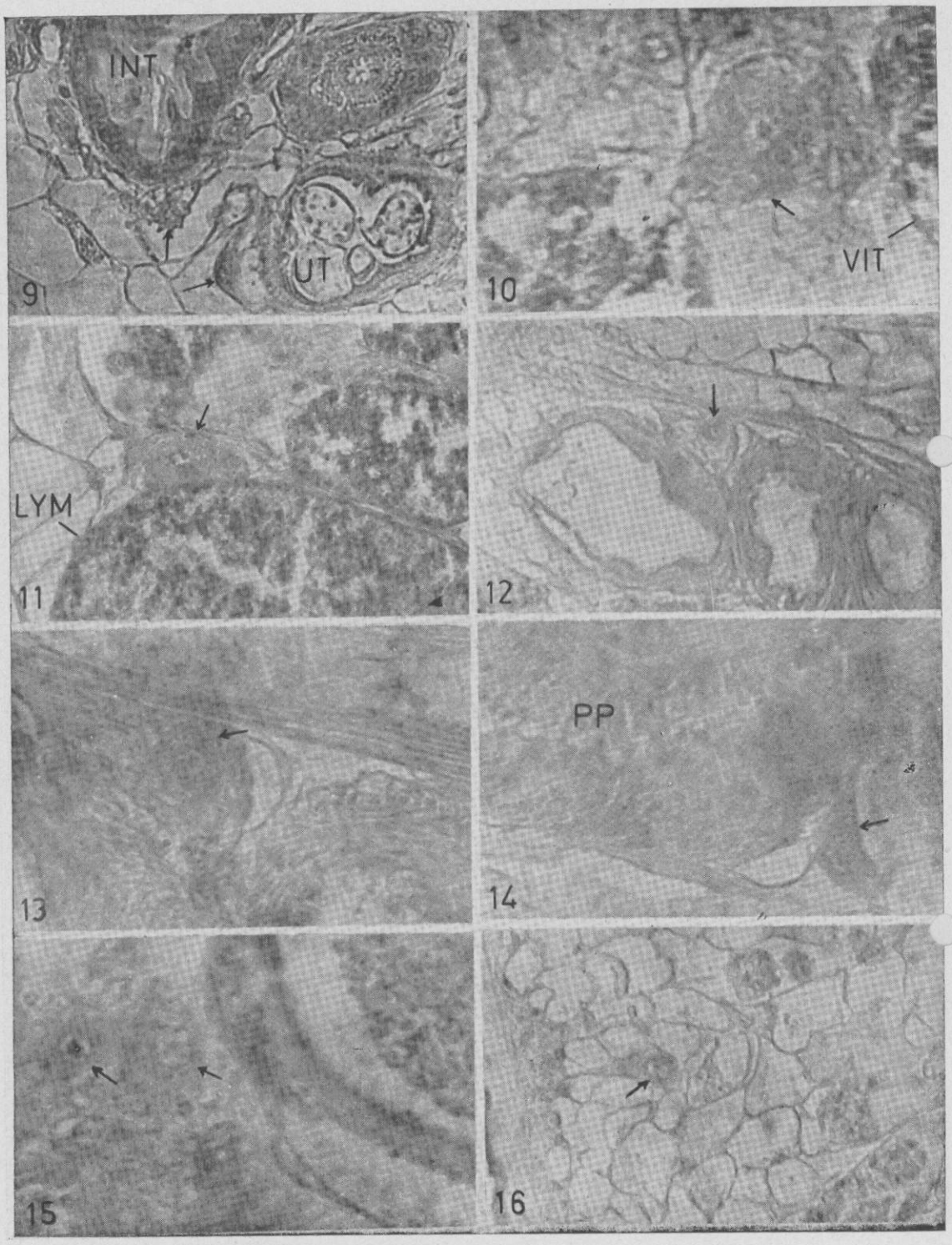
The NSC in the brain and nerve cord were more conspicuous than their counterparts in other locations of the body and were confined mostly to their peripheral regions. Both A and B NSC could be observed together in a few sections of the nerve cord (Figs. 1 and 2).

The NSC in the pharynx (Fig. 3) were mostly ovoidal or rounded in shape with centric nucleus, some having a single nucleolus and others with 2-3 nucleoli.

The A type cells in the general parenchyma were conspicuous by the abundant secretory material in them (Fig. 4). The B type NSC in the parenchyma were mainly



Figs. 1-8. Neurosecretory cells in *Gastrothylax* sp. Fig. 1. Type A (larger arrow) and B (smaller arrow) in the nerve cord. ×320, Fig. 2×720, Fig. 3. A (left) and B (right), near the periphery of the pharynx ×660., Fig. 4. A with abundant secretion in the parenchyma × 610, Fig. 5. Bipolar A at the uterine wall (UT) × 650, Fig.6. B close to the wall of seminal vesicle (SV) × 470, Fig. 7. B in acetabulum ×400, Fig. 8. B in outer region of oesophagus (OES) × 650,



Figs. 9-16. Neurosecretory cells in *Gastrothytaz* sp. Fig. 9. A multipolar B outer to the intestinal wall (INT), a bipolar B in the region of uterus (UT) × 170, Fig. 10. B near vitelline follicle (VIT) × 680, Fig. 11. B in association with lymph vessel (LYM) × 480, Fig. 12. B in outer wall of pars musculosa × 160, Fig. 13. ×450, Fig. 14. B near pars prostatica (PP) × 480, Fig. 15. B near base of genital papilla × 660 and Fig. 16 B in subtegumental parenchyma × 630.

rounded or unipolar but a few bipolar ones with the axons measuring 36-82 were also observed.

The A type NSC located in the region of uterine coils were very few in number, mostly elongated and unipolar in shape and with a centric nucleus and eccentric single nucleolus ; a couple of biolar cells could also be observed at this site (Fig. 5). Most of the B type NSC in this location (Fig. 9) had eccentric nucleus and centric nucleolus and so were the B type cells present in the region of the seminal vesicle (Fig. 6).

The other parts of the body where only B type NSC were observed include the acetabulum, oesophagus, outer layer of the intestinal wall, vitellaria, lymph vessels, pars musculosa, pars prostatica, genital papilla and subtegumental region (Figs. 7-16). A few cells in association with vitellaria had 2-3 nucleoli. A single multipolar NSC was observed just outer to the intestinal wall (Fig. 9). Those in association with the lymph vessels showed a similarity in size to the A type cells but in contrast to the latter, did not exhibit any vacuolation in their cytoplasm.

Of all the organs, the acetabulum had the maximum number of NSC which were uni- or bipolar.

DISCUSSION

Two morphologically distinct types of NSC have been reported for *Fasciola* spp. (Gresson and Threadgold, 1964; Grasso, 1967a, b ; Shyamasundari and Hanumantha Rao, 1975) and amphistomid flukes like *O. diplodiscoides* (Matskasi, 1970), *P. epiclitum* (Mehrotra and Bhutia, 1977) and *Pleisiochorus* sp. (Hanumantha Rao and Shyamasundari, 1977). In *Gastrothylax* sp. type A cells were found not only restricted to the regions of the brain and nerve cord but were also present in the pharynx, parenchymatous tissue and close to the uterine coils. As in *P. epiclitum* and *Pleisiochorus* sp., in *Gastrothylax* sp. also the B type NSC could be located in or in association with almost all the organs of the body. In view of the fact that the NSC were located at many a site which are not near the cerebral ganglion, this again strengthens our earlier belief (Mehrotra and Bhutia, 1977), in conformity with Dixon and Mercer (1965), of a possible transport of neurosecretory substances (NSS) from the axons of the NSC to the target cells or organ. The demonstration of NSC in the vicinity of the lymph vessels and close to their walls also indicates that the lymphatic system, present in this fluke and in other amphistomid trematode, could also serve as a carrier of the NSS to the various parts of the body and thus be considered a means of extracellular transport of NSS.

Thanks are due to Dr. H. O. Agrawal, Head, Deptt. of Biosciences, H. P. University for providing laboratory facilities.

REFERENCES

Dixon K. E. and Mercer, E. H. 1965. The fine structure of nervous system of the cercaria of liver fluke. *Fasciola hepatica*, *J. Parasitol.* **51,** 967-976.

Grasso, M. 1967a. Distributione e attivita delle cellule neurosecretrici in *Fasciola hepatica*. *R. C. Accad. Naz. Lincei.* **42,** 85-87.

Grasso, M. 1967b. Prime indagini sulla presenza di cellule neurosecretrici in *Fasciola hepatica*. *R. C. Acad. Naz. Lincei* **42,** 903-905.

Grasso, M. and Quaglia, A. 1974. Electron microscope observation in *Fasciola hepatica* L. *R. C. Acad. Naz. Lincei.* **56,** 631-634.

Gresson, R. and Threadgold, L. 1964. The large neurons and interstitial material of *Fasciola hepatica L. Proc. Roy. Soc. Edinb.* **42,** 261-266.

Hanumantha Rao, K. and Shyamasundari, A. 1977.. The structure and cytochemistry of neurosecretory cells in *Pleisiochorus* sp. (Trematoda, Digenea.). *All-India Symposium on Helminthology,* University of Kashmir, Srinagar, Abstract No. 60.

HARRIS, K. R. AND CHENG, T. C. 1972. Presumptive neurosecretion in *Leucochloridiomorpha constantiae* (Trematoda) and its possible role in governing maturation. *Int. J. Parasitol.* **2,** 361-367.

MATSKASI, I. 1970. On the neurosecretory cells of *Opisthodiscus diplodiscoides* Cohn (Trematoda), and their structural changes during the day. *Folia Parasit.*, **17,** 25-30.

MEHROTRA, V. AND BHUTIA, P. T. 1977. Observations on the neurosecretory cells of the sheep's rumen fluke, *Paramphistomum epiclitum* Fischoeder. *All-India symposium on Helminthology*, Univresity of Kashmir, Srinagar, Abstract No. 33.

REISIGG, M. 1970. Characterization of cell types in the parenchyma of *Schistosoma mansoni*. *Parasitology*, **60,** 273-279.

SHYAMASUNDARI, K. AND HANUMANTHA RAO, K. 1975. The structure and cytochemistry of neurosecretory cells of *Fasciola gigantica* Cobbold and *Fasciola hepatica* L. *Z. Parasitenk.* **47,** 103-109.

SILK, M. H. AND SPENCE, I. M. 1969. Ultrastructural studies of the blood fluke *Schistosoma mansoni* III. The nerve tissue and sensory structure. *S. Afr. J. Med. Sci.* **34,** 93-104.

UDE, J. 1962. Neurosecretorische zellen im cerebral ganglion von *Dicrocoelium lanceatum* St. u. H. (Trematoda, (Digenea). *Zool. Anz.* **169,** 455-457.

WILSON, R. A. 1970. Fine structure of the nervous system and specialized nerve endings in the miracidium of *Fasciola hepatica*. *Parasitology*, **60,** 399-410.