

Insect trappings in Arabian Sea with special reference to west coast of India

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Live and dead insects were collected during cruise # 238 of *Research Vessel Gaveshani* during October-November 1993. The cruise covered an area between 70° E to 73° E and 10° to 15° N in the Arabian Sea. These included airborne insects as well as those in the flotsam. A total of 103 airborne insects, belonging to 8 orders and 14 families were trapped. Of these, 6 specimens belonged to microlepidoptera. Hemiptera was the dominant order with a total of 58 specimens out of which 39 belonged to sub order Homoptera. Odonata was represented by 11 specimens of a single species *Pantala flavescence* Fabr. which not only remained hovering over the ship throughout the cruise, but also showed the peculiar behaviour of flying along side the country boats that ferried the scientists between various islands in the Lakshadweep group and the mother ship. A total of 23 dead insects belonging to 7 different orders and 11 families were collected as part of the flotsam. Most of these insects were complete and undamaged indicating that these had fallen in waters less than 12 h before being collected. A total of four specimens belonging to the only true marine insect *Halobates* were also collected as part of the flotsam. Some specimens of *Halovelia* sp. and *Xenobates* sp. were also collected. A coleopteran belonging to family Staphylinidae and some nymphs of an unidentified heteropteran were found associated with rotting sea grass on the shore on Agatti island in the Lakshadweep group of islands.

Except for one family which has become endemic in the oceans¹, all insects are essentially terrestrial forms including those that have secondarily adapted to fresh water existence. Such being the case, insects are not expected in the marine environment in any significant manner. However, large number of insects of terrestrial origin are found over and in the oceanic waters. Terrestrial insects, particularly the small sized ones, are carried up with thermal currents and then across the oceans with the help of wind currents. The insects are thus transported to distant lands, covering more than 5000 km in some cases². The passage of insects over the oceans is almost passive, the insect conserving all its energy except for what is required for respiration. A very large proportion of these insects, while being carried over the oceans, fall in the waters and contribute to the oceanic biomass³. Studies of airborne as well as truly marine insects have been mainly carried out in the Pacific Ocean and to a lesser extent in the Atlantic and the North Sea¹. Indian Ocean (with land masses which are perhaps the richest as far as insect diversity is concerned viz. Africa in the west, Indian subcontinent in the north and south east Asia in the east), has not

been investigated for insects except for some isolated reports^{4,6}. Results of an exploration for insects in some areas of the Arabian Sea, particularly along the west coast of India, are presented here.

The area of investigation lay between 70° to 73° E and 10° to 15° N (Fig. 1). The cruise (# 238, RV

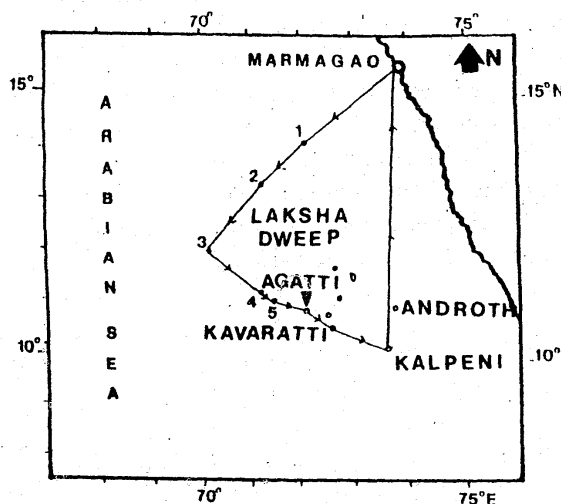


Fig. 1—Track of cruise # 238, RV *Gaveshani* in the Arabian Sea and the Lakshadweep islands

Gaveshani; October, 29 to Nov. 10, 1993) covered both coastal as well as open waters, besides the waters around the Lakshadweep islands.

Airborne insects were trapped using 1.5 m long conical, hand collection nets (diameter of the opening : 50 cm). The collections were made on the deck, bridge and other open spaces on the vessel. Flotsam collections were made using standard zooplankton nets which were towed over the surface water, up to a depth of 1 m, with the vessel moving at a speed of 4 knots per hour, for 30 min. each. Zooplankton nets were also operated from country boats which ferried the scientists to and from the various islands in the Lakshadweep group. The time of operation in such cases was reduced to 15 min. Preliminary separation of various species of insects trapped, both airborne and in the flotsam was carried out on the vessel itself and identifications were made later. The insects were stored in 80 % alcohol. All insects as well as insect parts, recovered from the flotsam samples were carefully weighed using a single pan balance with an accuracy of ± 1 mg.

A total of 103 airborne insects, belonging to 8 different orders were collected in the course of the cruise (Table 1). Of these, 88 belonged to 11 different families of various orders. One sample of moth was so much damaged that it could not be identified even up to the family and 14 specimens belonging to microlepidoptera could not be identified. An interesting observation on this cruise was the presence of large number of dragonflies, *Pantala flavescens* Fabr. over the vessel. Eleven specimens of this species were collected. It was noted that these insects not only remained in the vicinity of the vessel, but also flew along the country boats which ferried the scientists between the ship and the islands of the Lakshadweep group. On the beaches of these islands, associated with the rotting seagrass, were noticed some unidentified insects including the nymph of a heteropteran and a staphylinid beetle.

Flotsam samples collected in the course of the cruise showed the presence of 11 live insects, belonging to families Gerridae and Veliidae (Heteroptera), besides the exuvia of the fourth nymph of a gerrid. The gerrids were identified as *Halobates germanus* and *Halobates micans*. Specimens belonging to family Veliidae included *Halovelia* sp. (1 male and 4 females) at stations 1 and 2. A single third instar nymph of the same species was also collected off Kavaratti island. Two female adults of *Xenobates* sp. were trapped at station 5. While in-

Table 1—Orderwise distribution of airborne insects as well as those recovered from the flotsam in the Arabian sea during cruise # 238 of *RV Gaveshani*

Sl. No.	Order	Number of insects collected		Total number of insects collected
		Airborne	From flotsam	
1.	Hemiptera	58	17	75
2.	Lepidoptera	17	—	17
3.	Odonata	11	—	11
4.	Diptera	05	04	09
5.	Trichoptera	06	01	07
6.	Coleoptera	02	03	05
7.	Neuroptera	03	—	03
8.	Dictyoptera	01	—	01
9.	Thysanura	—	01	01
10.	Hymenoptera	—	01	01

sects of subfamily Halobatinae, family Gerridae are known as the only truly marine insects, those belonging to family Veliidae are mainly restricted to the coastal waters, coral reefs and rocky coastline. Besides these marine insects, 15 insects of terrestrial origin, dead but intact, belonging to 10 different families of 6 orders, were also found floating in the samples. A number of insect wings, legs, antennae and chitin pieces in various stages of disintegration, were also found in each sample. Total weight of the insects in the flotsam, (including live marine insects, dead insects of terrestrial origin and disintegrating/broken insect parts) was recorded as 1.097 g. Based on this, the standing crop of the insects, in terms of numbers, came to $0.14 \times 10^5/\text{km}^2$ and in terms of biomass to $57.72 \text{ g}/\text{km}^2$.

Except for some isolated reports, insects drifting from the surrounding land masses in the Indian Ocean have not been studied. Scudder⁴ had collected a heteropteran in the central part of the Indian Ocean. Some airborne insects were trapped in the course of the Danish oceanographic expedition —“Galathea expedition” of 1950-52, mainly along the coastal region of the Bay of Bengal⁵. Pathak & Parulekar⁶ reported trapping of some airborne insects in the Arabian Sea. Another aspect which has not even been discussed, is the fate of these airborne insects and their contribution to the oceanic biomass. Trapping of airborne insects in the present investigation reveals that most of the insects trapped in relatively large numbers are small ones which get carried away by winds flowing from land towards the ocean. At the same time, presence of a large insect, like preying mantis, is intriguing. But

even more intriguing is the presence and the constant company provided by the dragonfly *Pantala flavescens*, 11 specimens of which were trapped. Mitra⁷ reported that dragonflies follow moving objects, but all such reports so far have been over the land and none over the sea.

Study of distribution of the truly marine insects in various parts of the Indian Ocean is yet to be carried out systematically. Veliids are small water striders which inhabit coastal waters and intertidal zone of coral and rocky coasts⁸. In the light of this, it is difficult to explain the presence of veliids at stations 1 and 2 which are at least 120 km from the nearest islands (Lakshadweep). Evidently the range of their drift in the ocean is quite large. Presence of the third nymph of *Halovelis* sp. off the coast of Kavaratti island and *Xenobates* at station 5 appears to be normal as these two species have been reported off Goa coast and Pichavaram in Tamilnadu respectively⁹.

As regards the four specimens of *Halobates*, two belong to *H. micans* and the other two to *H. germanus*. Other studies^{10,11} on this subject have considered *H. micans* to be the dominant species in the area of present investigation, while *H. germanus* is said to be the dominant one in the Pacific Ocean, the westernmost limit being the Andaman Sea. However some authors have reported *H. germanus* along the coast of Madagascar¹². Other species noted in the vicinity of Madagascar include *H. al-luaudi*, *H. poseidon* and *H. flaviventris*¹³. Cheng¹⁴ while reviewing the biology of the genus *Halobates*, noted that the species distributed in the Arabian Sea, closer to the Indian coastline included *H. flaviventris*, *H. galatea* and *H. trynae*. While some of these species mentioned have not been collected in the present study, the presence of *H. germanus* in this area appears to be a new record.

The fact that most of the airborne insects trapped were small and weak flying ones, is as per expectations as once they get caught in the thermal currents and are carried up, they are then carried by seaward wind currents and are unable to return to their normal habitats on land. Ultimately most of these insects must get exhausted and fall in the water below, contributing to the oceanic biomass. Whether this contribution has some significance remains to be studied. Cheng¹⁵ stated that the remains of terrestrial insects certainly constitute an appreciable contribution of 2 g/km² to the pleuston. But it is also true that these figures vary from re-

gion to region and season to season, being 2 g/km² for the north Pacific in winter¹⁵, 25 g / km² for the Black Sea in summer¹⁶, 60 g / km² for the Gulf of California in March, 20 g / km² for the eastern Pacific Ocean off the coast of Oregon (USA) in summer and 170 g / km² for the English channel in summer¹⁴. In all these estimates, the average weight of an insect is assumed as 1 mg. In the present investigation, insect biomass in the seawaters in the months of October and November, based on the actual weight rather than any assumed one, works out to 57.72 g/km². Expressed in terms of number of insects per km², the standing crop was estimated at 0.14×10^5 . Similar figures for the Gulf of California (March), eastern Pacific off the coast of Oregon, USA in summer and English channel in April are reported⁴ as 0.6×10^5 , 0.2×10^5 and 1.7×10^5 /km² respectively.

Insect trapping programmes over the oceans have shed new light on zoogeographic distribution of these essentially terrestrial forms, indicating the pattern of dispersal and colonization of new areas. This has helped in understanding some of the trends in evolution of insect species². While some studies have been made in the Pacific and Atlantic oceans, hardly any have been undertaken in the Indian Ocean, particularly around the Indian peninsula. With African continent in the west, Indian sub continent in the north and south east Asian islands in the east, this area may indeed be extremely rich in insect fauna.

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