the top in each genotype was used for rearing. The fresh leaves were provided daily after cleaning the tins. The total number of larvae and average weight of ten larvae were recorded at 5 days interval and pupae were kept in egg laying cages for moth emergence. Fresh groundnut plants wrapped with wet cotton were provided for egg laying. The total number of eggs in a mass was counted using a magnifying lens[8].

The *S. litura* larvae reared on mutants 28-2 and 45 consistently showed less leaf damage (Figure 1), high mortality, low weight and low gain in weight compared to susceptible check and parents at all the stages (Table 2). On these criteria, the mutants were comparable or even superior to resistant check. The mortality and the low gain in weight were very much pronounced especially at the early stages of the larval period indicating the effect of the existing resistant factor on neonate larvae. The resistance effect of these mutants also extended the larval period by three days and had pronounced effect on the fecundity of moths. The mortality at initial stages, low larval weight, extension of larval period and low fecundity indicate the possible role of antibiosis as a mechanism of resistance in mutants 28-2 and 45 (ref. 9). The resistant mutants along with their parents can constitute the most ideal material to establish the role of specific chemicals affecting the insect pest.

The mutants (28-2 and 45) were earlier found to be resistant to late leafspot disease and early maturing with good pod and kernel features[7]. Therefore they can be widely tested for their suitability in commercial cultivation. The pest and disease resistant nature of these mutants can be profitably exploited in future breeding programmes.

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M. N. RAJENDRAPRASAD
M. V. C. GOWDA*
G. K. NAIDU

Department of Genetics and Plant Breeding,
University of Agricultural Sciences, Dharwad 580 005, India
**For correspondence.*
e-mail: root@zrckar08.kar.nic.in

On the coral reefs of the Gulf of Kachchh

The Gulf of Kachchh (22°15′ to 23°40′N and 68°20′ to 70°40′E) is a 7350 km^2 east-west oriented indentation lying between the Kachchh mainland and the Saurashtra Peninsula. The only reported site for coral formations in the Gulf of Kachchh is between 22°20′N and 22°40′N latitudes and 69° and 70°E longitudes along the coast of Jamnagar district[1].

Based on the existing classifications these reefs are grouped into fringing reefs (north of Okha, north of Beyt Shankhodar, fringing the mainland from Dhani beyt to Sikka, Jindra and Chad, Pirotan, near Valsura), platform reefs (Paga reefs, Bural Chank, Karumbhar, Munde reef, etc.), patch reefs (Goos and Ajad) and several coral pinnacles (e.g. Chandri, etc.)[2].

Observations on the coral reefs of the gulf using satellite imageries have so far been restricted only to the intertidal reefs because of the limitations in depth penetration of the sensors[3]. The reefs get exposed only during low tides[4]. As a result, available imageries and existing data from the Gulf of Kachchh are only

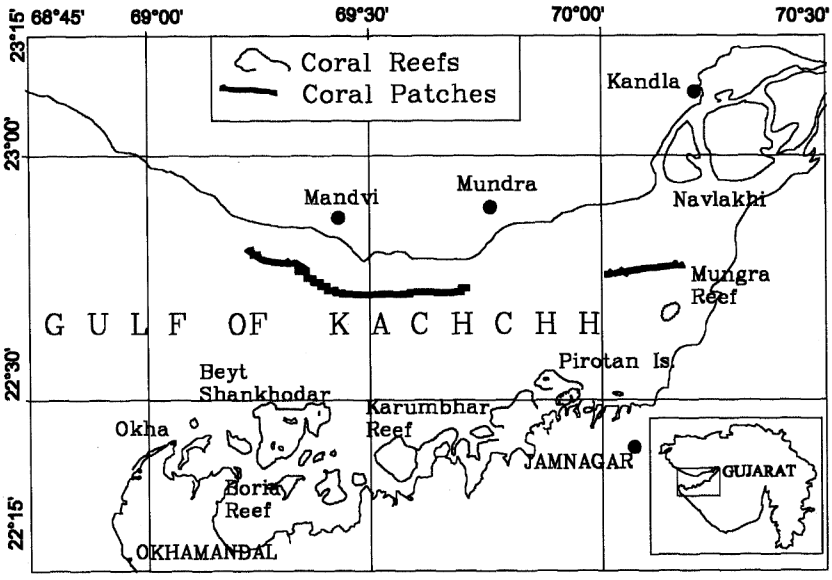

Figure 1. Coral distribution along the Gulf of Kachchh.

Table 1. GPS positions of existence of live corals in the sub-tidal zone of the Gulf of Kachchh

Station	GPS position	Depth (m)	Substratum
Okha (Beyt Shankhodar)*	22°25′197N 069°05′069E	8	Coral, coralline sand, muddy
Boria*	22°24′423N 069°13′124E	5–8	Coral, sand
Karumbhar*	22°28′728N 069°37′992E and 22°27′841N 069°37′074E	6–9	Coral, rocky
Pirotan*	22°37′066N 069°57′491E and 22°37′273N 069°58′274E	5–8	Rocky
Mungra reef**	22°46′398N to 22°46′675N 070°08′220E to 70°10′829E	15–25	Muddy, rocky
Mundra**	22°42′881N to 22°45′147N 069°18′658E to 069°41′112E	8–20	Rocky
Mandvi**	22°47′078N to 22°47′613N 069°14′362E to 069°14′864E	5–15	Rocky

*Diving sampling; **Dredge and grab sampling.

from those reefs and reef flats which are shallow, inter-tidal and get exposed during low tide.

Considering the limitations of satellite imagery and the absence of information from the deeper zones of the coral reefs of the Gulf of Kachchh, we thought it will be interesting and worthwhile to have a view of the sub-tidal regions of the coral reefs which never get exposed during low tides. This article reports the existence of live corals at the sub-tidal regions. It redefines the eastern and northern limits of coral distribution in the gulf.

While surveying the Gulf of Kachchh for the Department of Ocean Development, Govt. of India, New Delhi, under their ICMAM (Integrated Coastal and

Table 2. Sub-tidal coral biodiversity along the Gulf of Kachchh

Station	Stony corals	Soft corals	Associated fauna	Associated flora
Pirotan*	*Favia favus, Favites melicerum, Goniopora nigra, G. planulata, Montipora* sp., *Platigyra sinensis, P. compressa, Tubastrea aurea*	Gorgonians	Perch fish, puffer fish, *Sabella* sp., sea anemone, Sponges, *Acanthaster planci*, bryozoans, gastropod, *Bonelia* sp., crabs, *Panularus polyphagus* (spiny lobster), *Lytocarpus* colony	*Caulerpa, Codium, Ulva, coralline* algae, *Enteromorpha. Gracilaria, Hypnea, Padina, Sargassum, Soliera*
Karumbhar*	*Cymfavia radians, Favia favus, F. specicosa, Favites melicerum, Goniastrea pectinata, G. planulata, Platigyra sinensis, Porites* sp., *P. compressa, Tubastrea aurea, Turbinaria peltata*	*Astromuriacea stelligera*, gorgonians, *Dendronephthya dendrophyta, Lophogorgya lutkeni, Nephthya* sp.	Perch fish, *Pomacanthus annularis, Sabella* sp., sea anemone, *Antedon,* sponges, sea lily, brittle star, bryozoan, hydrozoans, gastropods, polychaete, *Triphyllozooan* sp., crabs	*Caulerpa, Ulva,* coralline algae, *Enteromorpha, Halimeda, Hypnea,* Sargassum, *Soliera*
Boria Reef*	*Montipora* sp. *Porites* sp., *Turbinaria peltata*	*Dendronephthya, dendrophyta, D. brevirama,* gorgonians, *Nephthya* sp.	Sea lily, bryozoans, gastropods, crabs, sponges	*Caulerpa, Codium,* coralline algae, *Gracilaria, Halimenia, Hypnea, Kjellimania, Sargassum, Soliera*
Beyt Shankhodar*	*Goniopora nigra, Turbinaria peltata*	*Dendronephthya dendrophyta, D. brevirama, gorgonians, Lobophytum panciglosum, Nephthya* sp,. *Sclerophytum polydactylum, Sinularia* sp.	Sea anemone, *Discosoma* sp., sponges, sea lily, bryozoans, gastropods	*Caulerpa, Halimenia, Kjellimania,* Sargassum, *Soliera*
Mungra reef	Young polyps–colony of *Tubastrea* sp., *Porites* sp.	Gorgonians	Bryozoans, gastropods, crabs, polychaetes, sponges, sea urchins	*Ulva,* coralline algae
Mundra	Young polyps–colony of *Tubastrea* sp., dead *Acropora* pieces	Gorgonians, *Dendronephthya* sp.	*Holothuria* sp., brittle star, *Antedon*, sea urchins, gastropods, *Membranopora*	Coralline algae
Mandvi	Young polyps–colony of *Tubastrea* sp.	–	Sponges, bryozoans, *Membranopora*, barnacle, gastropods, oyster spats	*Dictyota bartreysiana*

*All the coral forms and associated fauna were identified by Mafatlal I. Patel, Commissionerate of Fisheries, Government of Gujarat, Gandhinagar.

Marine Area Management) studies in October 1998, a few live coral polyps were collected by grab sampling at Mungra, off Jodia (Figure 1). Further investigations on these sub-tidal areas were carried out in two stages: a) Investigating the sub-tidal coral reefs by SCUBA diving, around four of the islands, namely Pirotan, Karumbhar, Boria and Beyt Shankhodar in February 1999; b) Grab and dredge samplings during two *CRV Sagar Paschimi* cruises during March 1999 and February 2000 (Figure 1). Five grids were examined during the first cruise at Okha, Karumbhar, Pirotan, Mungra (on the eastern Gulf) and Mundra (northern Gulf) by grab sampling only. A few live corals with associate fauna and flora were collected in grab samples from Mungra and Mundra. As this was the first report on the occurrence of live corals from those two areas (M. I. Patel, personal discussions) the survey was repeated using a shallow water chain dredge in February 2000. One more grid at Mandvi (northern side) was added during the second cruise. Details of the diving and dredging sites are presented in Table 1.

Live corals – both soft and stony are abundantly present in the sub-tidal regions of the reefs at various stages of growth. The genera observed for stony corals are: *Favia*, *Favites*, *Goniopora*, *Montipora*, *Sinularia*, *Tubastrea*, *Turbinaria* and broken branches of *Acropora*. The soft coral genera are *Dendronephthya* and *Nephthya*. Stony corals dominate the Pirotan reef while soft corals dominate the other reefs. A total of 12 species of stony corals, 7 species of soft corals, 28 species of benthic marine algae and 23 species of benthic fauna could be recorded during the underwater survey (Table 2).

The abundance of live corals decreased from the inner to the outer reefs, from 75 to 80 per cent at Pirotan and Karumbhar to around 50 per cent at Boria and Beyt Shankhodhar. Siltation varied from moderate to fairly high from the inner to the outer reefs. Underwater tidal currents were stronger at the inner reefs.

The Munde reef and Pirotan island mark the northernmost extent of coral patches and the easternmost limit is the Mungra reef near Jodia (Table 1, Figure 1). Solitary corals are believed to exist as far as Jakhau in the north and Dwarka on the Saurashtra coast.

The dredging survey off Mundra, about 2–3 km off Adani Port, covering an area of around 8 km^2 revealed a plethora of live corals, *Tubastrea* sp. and live polyps with plenty of gorgonians, soft coral *Dendronephthya* sp., bryozoans, brittle star, sea urchins, holothurians, polychaetes with the algae *Ulva* sp. and dead *Acropora* branches. This area seems to be a place of growing corals (Figure 1). Dredging off Mandvi covering 3.5 km^2 revealed similar assortment of live corals with their associate flora and fauna. These pioneering observations led us to conclude that a considerable area in the northwestern Gulf of Kachchh has live corals. Details are presented in Table 2. Inclusion of these sub-tidal live corals will certainly change the currently held belief that there are 20–30% corals in the Gulf of Kachchh which are alive.

The number of scleractinian coral species reported earlier from the Gulf vary from 37 belonging to 22 genera[1] to 44 species of stony and 12 soft coral species[5] to 40 species of 23 genera and 3 species of soft corals[6]. This fragile and isolated ecosystem that contributes to the shore stability needs to be further investigated. It will soon be subjected to increasing stress with ever increasing oil import activities in the Gulf of Kachchh.

We opine that corals always existed off the northern coast of the Gulf, but were covered by the prograding sediments from River Indus. The rate of sedimentation is very high on the northern shores, which leaves the southern shores almost starved of sedimentation because of the existence of a dynamic barrier in between created by the high velocity tidal stream flowing through the central channel of the gulf[7]. During the recent years it has been concluded that the sediment outflow from River Indus has reduced to 50×10^6 tonnes.yr^{-1} from the earlier 250×10^6 tonnes.yr^{-1} because of the construction of several barriers across the river[8]. It is very probable that the corals may have come back to life with the reduction in the amount of sediment. This is, perhaps, evident from the abundance of polyps and small growing corals with little or no marine algal growth.

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GEETANJALI DESHMUKHE*
K. RAMAMOORTHY
R. SEN GUPTA

Gujarat Ecological Society,
5 Golden Apartment, Subhanpura,
Vadodara 390 023, India
**For correspondence.*
e-mail: gesbrd@vsnl.com