

PRELIMINARY SURVEY OF RODENTS IN TWO TRANSMIGRATION SCHEMES IN SOUTH SUMATRA, INDONESIA.

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Penelitian ini merupakan sebagian dari survey biomedis yang dilakukan di daerah transmigrasi Baturaja-Martapura (Sumatera Selatan) dan Mulyorejo, Way Abung III Lampung pada bulan September dan Oktober 1977. Tikus² liar ditangkap dan dipelajari untuk mengetahui peranannya sebagai penyebar penyakit.

R.r. diardii merupakan spesies yang lebih banyak ditemukan didaerah perumahan dikedua daerah transmigrasi tersebut. Hasil pemeriksaan parasitologis menunjukkan bahwa pengerahan spesies ini tidak terbatas didaerah perumahan saja. Diladang sekitar perumahan dikedua daerah tersebut R. tiomanicus lebih banyak ditemukan dari pada R. exulans dan R. argentiventer. Kertas kerja ini menyimpulkan bahwa dengan adanya hoepes dan vektor yang tepat di daerah-daerah tersebut ada kemungkinan akan timbulnya penyakit dernam semak (scrub typhus) dan mungkin juga eosinophilic meningo encephalitis dikalangan para transmigrasi, selain penyakit arbovirus yang lain.

In September and October, 1977 a combined team from the Zoonoses Sub Division of the National Institute of Health Research and Development, Ministry of Health, Indonesia and two members of WHO Vector and Rodent Control Research Unit, No. 2 (VRCRU-2) attached to the Institute Jakarta conducted a biomedical survey at Baturaja Martapura (Province of South Sumatera) and Mulyorejo, Way Abung III (Province of Lampung) in South Sumatera (Fig. 1)

The objective of this survey was to investigate the reservoirs and vectors of zoonotic diseases in land development schemes areas, and in particular, to attempt to determine whether such vectors are indigenous or introduced by man due to alteration of the habitats. The present paper deals with the distribution pattern of feral rats and

their potential hazard as transmitting agents of disease; this forms only one aspect of the studies.

STUDY AREAS

Baturaja, Martapura Transmigration Scheme: This scheme is situated southeast to the nearest town, Baturaja which is 12 kilometers away. Martapura, originally a forest, was opened in January 1976. The total area for the whole scheme is 65,000 hectares. The scheme is divided into 11 units.

The first group of 50 families of transmigrants from West Java arrived in October 1976, and to date there are 404 families. Each family size averages five persons, thus there are altogether some 2020 inhabitants. It is anticipated that 2000 families will be transmigrated into this scheme by 1980. Each family is allotted four hectares of land inclusive of the house.

Mulyorejo - 3rd Unit at Way Abung III: Way Abung III Transmigration scheme

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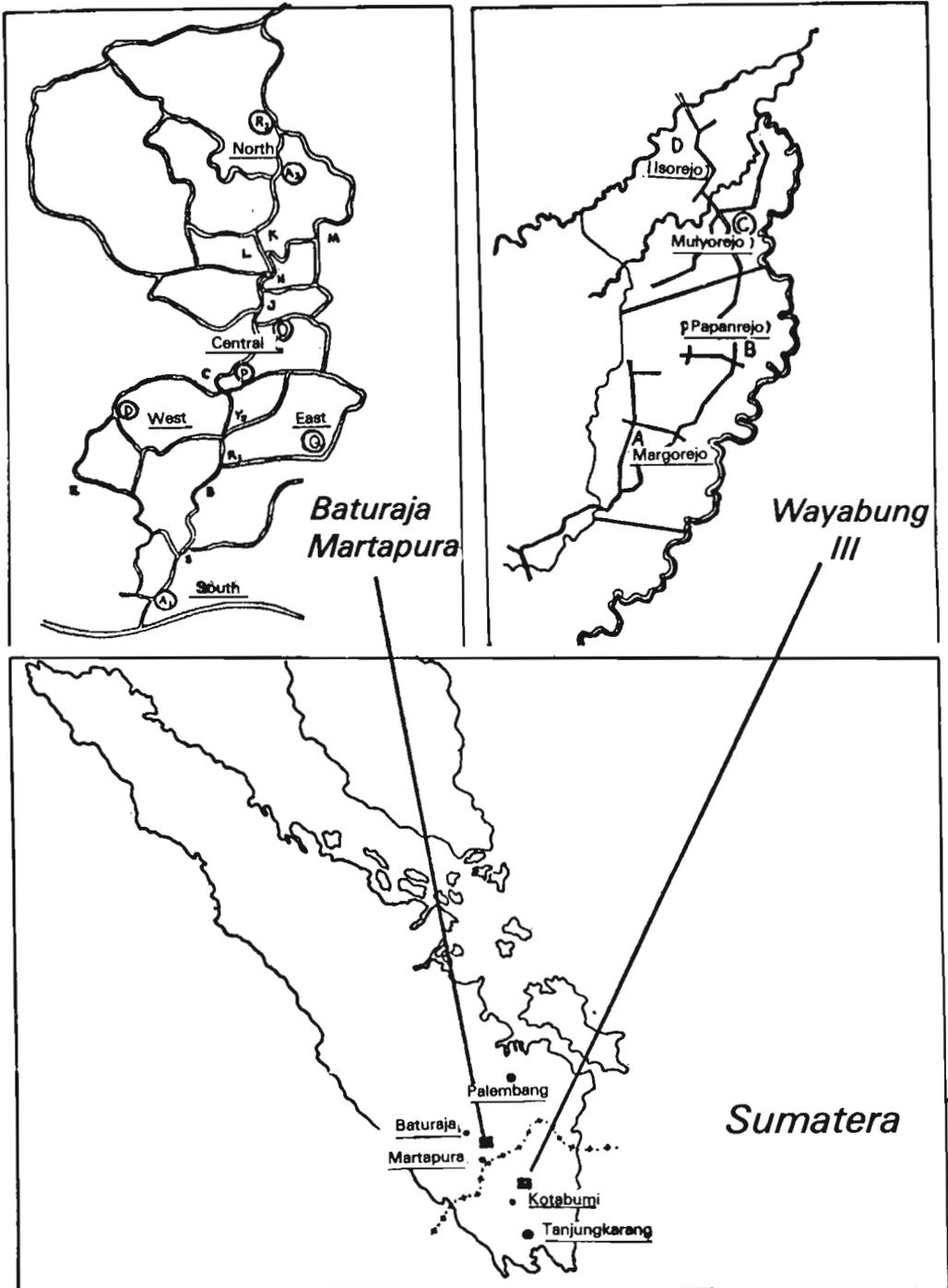


Fig. Study area of the multidisciplinary survey for vectors of Zoonotic diseases.

is 20 kilometers from the nearest town, Kotabumi. The scheme has a total area of 12,500 hectares. This scheme, originally a forest, was opened in January 1974. Way Abung III is divided into four units (Margorejo Unit 1, Papanrejo - Unit 2, Mulyorejo - Unit 3, Isorejo - Unit 4). Transmigration started in June 1974 with the latest group of transmigrants having arrived a year ago at Mulyorejo and Isorejo.

Each unit is targeted for 500 families. Each family size is about five persons, thus the total population for the whole area will in time be about 10,000 people. All the transmigrants were from Central, West and East Java. Each family is allotted with two hectares of land inclusive a house.

MATERIAL AND METHODS

Trapping of rodents: Trapping of rodents at Baturaja Martapura transmigration scheme was carried out by sampling certain blocks of houses using the dispensary as the centre point of direction, and they are as follows: Central Blocks O (18 families) and P (27 families); North Bloks A² (19 families) and R² (27 families); West Blocks D (26 families) and E (23 families); South Block A¹ (26 families) East Block Q (21 families).

A total of 95 traps were used in Baturaja Martapura. Trapping was confined to within the human settlements and in the fields in each of the block. A trap was placed in the kitchen area inside houses. The remaining traps were placed in the fields which were 3 to 4 kilometers away from residential houses in each of the blocks. The fields are usually overgrown with lallang mixed with scrub

vegetations. Altogether, five nights of trapping were carried out.

A total of 90 traps were used in Mulyorejo, Way Abung III. Mulyorejo is divided into four blocks namely RK 1 (Central), Rk 2 (East), Rk 3 (South) and Rk 4 (West). Trapping of rodents was confined to Rk 1 and RK 4, and also in their adjacent fields. The habitat of these fields is identical to that of Baturaja Martapura. Rk 1 has 109 families and Rk 4 has 140 families. All the houses in Rk 1 were sampled, one trap to each house, and 60 houses only in Rk 4. Altogether, three nights of trapping were carried out in this scheme.

The traps baited with baked coconuts were set at 1700 hours in the evening and collected at 0700 hours in the next morning. The setting of traps were carried out by the outhur in the houses as well as in the fields so as to be sure that all traps set are operational.

All rats caught were transferred into cloth bags and brought back to the field laboratory and killed with chloroform. Blood smears were taken on filter papers and ectoparasites were removed from each individual animal. Female rats were examined for pregnancy records. Age group of the animal was determined by body weight groups. Samples of skind and skulls of some of these animals were preserved for a reference collection.

RESULTS

House Rodents : The overall trapping rate in Baturaja Martapura was 21.8 percent as compared to 39.6 percent at Mulyorejo (table 1). Both these rates were supposedly

Table 1. Trapping rate of house rodents in both transmigration schemes in Sumatera.

Locality	No. of traps	No. Animals caught				Total	Trap Success %
		<i>R.r. diardii</i>		<i>R. exulans</i>			
		♂	♀	♂	♀		
Baturaja Martapura	174	17	18	0	3	38	21.8
Mulyorejo	169	19	47	0	1	67	39.6

high which indicate high densities of rodents in these two scheme. Only two species of rodent (*Rattus r. diardii* and *R. exulans*) were caught in houses with *R.r.diardii* being the predominant species in both the schemes.

The density of young *R.r.diardii* (below 50 grams body weight) consisted of 17 percent (6/35) at Baturaja Martapura as compared to 13 percent (9/66) at Mulyorejo. Pregnancy rate of *R.r.diardii* at Baturaja Martapura was 66.7 percent (12/18) and 51 percent (24/47) at Mulyorejo (table 2). The mean litter size of pregnant female rats at Baturaja was 8.8 (range:5-11) and that of Mulyorejo was 9.1 (range 6-11) respectively.

Field Rodents : The overall of 17.4 percent trapping rate was achieved at Baturaja Martapura as compared to 12.4 percent at Mulyorejo (table 3). Four species of rodents, *R.tiomanicus*, *R.argentiventer*, *R.exulans* and *R. surifer* were obtained at Baturaja Martapura and only two species, *R.tiomanicus* and *R. exulans* at Mulyorejo. *R.tiomanicus* appears to be the predominant species in both schemes with *R. exulans* and *R.argentiventer* as secondary species. *R.surifer* a forest species, was obtained at the fringe

between scrub and cultivated field mixed with lallang vegetation.

All the *R.exulans* and *R. tiomanicus* examined from Mulyorejo were adults. At Baturaja Martapura, 25 percent (6/24) *R. tiomanicus* and 25 percent (2/8) *R. exulans* were young rats with body weight below 40 and 20 grams respectively. None of the female *R. tiomanicus* and *R. exulans* examined from Baturaja Martapura was pregnant whilst one of each of these species from Mulyorejo was pregnant with 7 and 8 embryos respectively.

Ectoparasites pattern: (It was interesting to note that no flea was found on any of the house and field rodent examined either from Baturaja Martapura or from Mulyorejo. But the prevalence of infestation of other ectoparasites was very high and the results are shown in tables 4.

In Baturaja Martapura, 68.6 percent (24/35) *R.r.diardii* from house was found to be infested with three species of chiggers as compared to 5.7. percent (2/35) with two species of ticks only. One of the *R. exulans* from house was infested with a single species chigger (Table 4). In Mulyorejo, 92.4 percent

Table 2. Prevalence of young (below 50 g) and pregnant *R.r. diardii* from the transmigration schemes in South Sumatera.

	Baturaja Martapura	Mulyorejo
Young rat	17% (6/35)	13% (9/66)
Gravid	66.7% (12/18)	51% (24/47)

Table 3. Trapping rate of field rodents in the transmigration schemes in South Sumatera.

Locality	No. of traps	No. of Animals caught								Total	% trap success
		<i>R. tiomanicus</i>		<i>R. argentiventer</i>		<i>R. exulans</i>		<i>R. surifer</i>			
		♂	♀	♂	♀	♂	♀	♂	♀		
Baturaja Martapura	201	12	12	1	1	7	1	1	0	35	17.4
Mulyorejo	89	5	2	0	0	2	2	0	0	11	12.4

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Table 4. Infestation of different ectoparasites by house and field rodents from both transmigration schemes in South Sumatera.

Ectoparasites	House Rodents				Field Rodents					
	Baturaja Martapura		Mulyorejo		Baturaja Martapura				Mulyorejo	
	R.d.	R.e.	R.d.	R.e.	R.t.	R.e.	R.a.	R.s.	R.t.	R.e.
Chiggers										
<i>Galrlipia (Walchia)d. disparunguis</i>	13(839)	0	15(792)	0	7(56)	4(128)	0	1(1)	4(41)	3(73)
<i>Galrlipia (W.)d. pingue</i>	0	0	42(3325)	1(92)	0	0	0	0	1(13)	1(1)
<i>Walchiella</i> sp.	2(5)	1(7)	0	0	0	0	0	0	0	0
<i>Ascoschoengastia (Laurentella) indica</i>	9(436)	0	4(198)	0	0	0	0	0	0	0
<i>Leptotrombidium (L.) deliense</i>	0	0	4(4)	0	17(419)	0	2(36)	0	1(2)	0
<i>Leptotrombidium (L.) fletcheri</i>	0	0	0	0	14(199)	1(1)	0	0	1(2)	0
Mesostigmatic mites										
<i>Laelaps echidrinus</i>	0	0	0	0	1(2)	0	0	1(3)	1(1)	0
<i>Laelaps aingworthe</i>	0	0	0	0	0	0	0	1(140)	0	0
<i>Longolaelaps</i> sp.	0	0	0	0	0	0	0	1(140)	0	0
Ticks										
<i>Haemaphysalis</i> sp.	2(2)	0	0	0	8(36)	0	0	0	1(5)	0
<i>Dermacentor</i> sp.	0	0	0	0	0	1(3)	1(1)	0	0	1(1)

Figure in parenthesis denotes the number of parasites collected from infested animals.

Figura precedes parenthesis denotes the number of rat hosts infested with specific parasites.

Abbreviations: R.d. = *Rattus r.diardii*
 R.e. = *Rattus exulans*
 R.t. = *R.tiomanicus*
 R.a. = *R. argentiventer*
 R.s. = *R. surifer*.

(61/66) *R.r.diardii* was infested with four species of chiggers and the single *R. exulans* from house was also infested a species of chiggers (Table 4)

All the chiggers species from house rats at Baturaja Martapura were non-vector species, but at Mulyorejo four *R.r.diardii* from houses were each infested with a single vector chigger, *Leptotrombidium (L) deliense*.

Infestation of ectoparasites among the field rodents in the two schemes was observed to be equally as high. In Baturaja Martapura 95.8 percent (23/24). *R. tiomanicus* and 50 percent (4/8) *R.exulans* were found to be infested with three species of chiggers and one species tick (table 4) as compared to 85.7 percent (6/7) *R.tiomanicus*

and 100 percent (4/4) *R.exulans* from Mulyorejo were infested with four species of chiggers, two species of ticks, and a species of mites (table 4). High prevalence of infestation with high number of vector chiggers *Leptotrombidium (L) deliense* and *L(L) fletcheri* by *R.tiomanicus* and *R.argentiventer* were observed at Baturaja Martapura, whilst in Mulyorejo only two *R.tiomanicus* were found infested with two of each *L (L) deliense* and *L (L) fletcheri*.

Endoparasites pattern: The endoparasites recovered from house and field rats were grouped into their main group of helminths namely, nematode, cestode and acanthocephala.

In Baturaja Martapura, 51.4 percent (18/35) *R.diardii* from house were infested

with helminths. 77.8 percent (14/18) of the infected *R.r.diardii* was found with cestodes in their livers and intestines as compared to 11.1 percent (2/18) with nematodes and 11.1 percent (2/18) with acanthocephala. In Mulyorejo, 19.7 percent (13/66) *R.r.diardii* from houses were infected 15.4 percent 2/13 of the infected *R.r.diardii* were infected with cestodes, 38.5 percent (5/13) with cestodes, 38.5 percent (5/13) with nematodes and 46.1 percent (6/13) with acanthocephala. *R. exulans* from houses in both the schemes were found free from helminth infection.

Among the field rodents examined from Baturaja Martapura 41.6 percent (10/24) *R. tiomanicus* 12.5 percent *R. exulans* and 50 percent (1/2) *R. argentiventer* were infected with nematodes only. At mulyorejo, 28.6 percent (2/7) *R. tiomanicus*, was infected with nematode and acanthocephala. All the *R. exulans* examined were not infected with helminths.

DISCUSSION

Most of the rodent species known to occur in Java (Kopstein, 1931) and Sumatera re dependent on the forest. Various species respond in different ways to alterations of the forest habitats. Clearing of the forest appears to reduce the population size of some species and enhance those of other. In the case of the Baturaja Martapura and Mulyorejo, Way Abung III transmigration schemes in South Sumatera, they were originally lowland forests and opened recently, the former scheme was about 1½ year old latter one was about 3½ year old. Transmigration started in Baturaja Martapura about a year ago, whereas in Way Abung III it started about 3 year ago with the latest group arriving a year ago at Mulyorejo-Unit 3. The habitats in these two development schemes were drastically altered thus greatly affecting the changing pattern of the mammalian fauna.

The present trapping results revealed that the forest species of rodent are scarce as indicated by only a single *R. surifer* having been trapped at Baturaja Martapura and none at Mulyorejo, Way Bung III. NAMRU-

2 personnel from Jakarta in August, 1975 surveyed two areas at Way Abung III which are 12 kilometers away from the present study area in Mulyorejo and obtained three species of forest rats *R. surifer*, *R. sabanus* and *R. niviventer* (unpublished data). It has been two years since they conducted their survey and probably at that time the areas where these forest rats were caught, were still partially forested. Two species of house rats, *R.r.diardii* and *R. exulans* were found in both Baturaja Martapura and Mulyorejo, Way Abung III, with *R.r.diardii* being the most predominant species. In the fields, three species of rodents, *R. tiomanicus*, *R. exulans* and *R. argentiventer* were found although *R. argentiventer* has yet to be observed at Mulyorejo, Way Abung III. NAMRU-2 personnel in their last survey mentioned above, found *R.r. diardii* predominantly in houses and did not take *R. argentiventer* in the fields. The present observations of the field rodents indicate that *R. tiomanicus* is more common than the latter two species.

Lim et. a. (1977) found *R. exulans* was the predominant species in houses in newly developed land scheme of one or two year old (FELDA- Federal Land Development Authority) in Pahang, Malaysia. *R.r.diardii* was found to be the predominant species in houses in such schemes in Pahang as well when the land had been developed and inhabited for three or more years. The present finding of *R.r.diardii* being the predominant species in houses in Mulyorejo, Way Abung III, where the land had been cleared and partially developed in inhabited for more than three years appears to agree with the findings of Lim et al (1977). In the case of Baturaja Martapura which was only opened in January 1976, the finding of *R.r.diardii* as predominant in houses poses some interesting questions. It is quite probably that *R.r.diardii* in the scheme could be due to a spread of this species from its neighbouring town and villages which are about 5 to 6 kilometers away or (b), it is also possible that there were already people living in the scheme long before the area was opened into a Transmigration

scheme.

On the other hand, the trapping success of field rodents in both the Schemes, revealed that *R.tiomanicus* appear to be more abundant than *R. exulans* and *R. argentiventer* in mixed lallang habitats. Lallang habitat is an intermediate succes of regeneration of forest clearing and therefore provides excellent niches for scrub typhus and others arthropod vectors. This is evidenced by the high rate of infestation and high density of vector chiggers *Leptotrombidium (L) deliense* found in rats inhabiting such habitat especially at Baturaja Martapura. *L[L] deliense* was first incriminated as a vector of scrub typhus in Sumatera (Walch, 1923). Since then no further records of the disease was reported.

However, the fact that the right kind of host and vector species chiggers together with the ideal man-made type of environment is present in these two Schemes, means that the risk of exposure to scrub typhus should not be overlooked.

The high rate of young *R.r.diardii*, *R.tiomanicus* and *R. exulans* and the high pregnancy rate of *R.r.diardii* in particular, observed in the present survey, revealed that there is a probable peak reproduction among these species during September/October in both the Schemes. The high ration of female rats found among these species is interesting. Pregnant females of these species were found with mean embryo size of 9.7 and 8 respectively. Harrison (1952) found that these species in Malaysia matured at the age of three months, and with a gestation period of 22 to 28 days and each of these species could produce six litters a year. If the same situation occurs in these species in the two Scheme areas, their numbers could in time increase very seriously if the natural population were left unchecked. Farmers in these two Schemes have already complained that these rats, particularly *R.r.diardii* is a serious pest in houses as well as in their cultivated fields. The high infestation rate and density of the chiggers in *R.r.diardii* and *R.tiomanicus* and low density in *R. exulans* agrees with the findings of Hadi et. al.(1976) of identical species in Ancol on the outskirts

of Jakarta. Audy (1965) showed that ectoparasites, particularly chiggers which were so dependant on the behaviour and habitats of potential hosts, might be regarded as "ecological labels" of the host species. Thus, the present observation of these rats with high density of chiggers, suggests that *R.r.diardii* in particular is not restricted to house only but also occupy field habitats in these two Schemes.

Provisional identification of the helminths showed *Angiostrongylus* spp were the commonest nematode found among infected *R. tiomanicus*, *R.r.diardii* and *R. exulans*. The nematode, cestode (*Hymenolepis* sp *Taenia* sp.) and acanthocephala (*monimiformis* sp) infection by these house and field rats, particularly the high prevalence of *Angiostrongylus* spp., a causative agent of human eosinophilic meningoencephalitis, in these rats was interesting.

Lim (1966-1970) expanded on the concept of ecological labels by Audy (1956) to include the food habits of hosts. The nematodes, cestodes and acanthocephala infections in these three species of rats appear to correlate with their normal food preference. The frequent occurrence of *Angiostrongylus* cestode (*Hymenolepis*) and acanthocephala (*Monimiformis*) on *R.r.diardii* and *R.tiomanicus* reflects their preference for snails and insects as food.

The absence of fleas particularly on commensal rats is most unusual. In our studies in Tanjung Priok, Jakarta and Ciloto West Java, *R.r.diardii* was found to have a fairly high flea index.

In conclusion, the present survey revealed that the commensal of house and field rats in these two schemes pose not only economic hazard but also that of zoonotic disease transmission. These rats particularly *R.tiomanicus* and *R. argentiventer* are shown to be good hosts of vector chigger and they are also good definitive hosts of the rat lungworm. *Angiostrongylus*. The vector chiggers may transmit scrub typhus to man, and the lungworm is an aetiological agent of human eosinophilic meningoencephalitis. The fact that suitable species of hosts and vectors are present, means that the risk of

exposures to these disease exists.

The present survey also showed that *R.r.diardii* appears to be a far more serious pest in houses and in cultivated fields than either *R. tiomanicus* and *R. exulans* in both these Schemes.

SUMMARY

As part of the biomedical survey conducted at Baturaja Martapura and Mulyorejo. Way Abung III in South Sumatera in September and October, 1977 feral rats were trapped and studied for their potential hazard as transmitting agents of diseases. *R.r.diardii* was found to be the predominant species in houses in both the schemes. Parasitological evidence has shown that this species does not confine its range of movement to house only. *R. tiomanicus* has been shown to be more abundant than *R. exulans* and *R. argentiventer* in surrounding fields in both the Schemes. The paper concludes by portending the risk of exposure to scrub typhus, and probably human eosinophilic meningoencephalitis, apart from other arbovirus diseases by transmigrants in these two Schemes, where the right host and vector species are present.

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