to be faster in a field of susceptible variety than that of a resistant variety and in spacing of 20 × 20 cm than 25 × 25 cm[2]. In another experiment at the International Rice Research Institute, Los Ba os, it had been observed that yield loss of a susceptible variety was significant at three levels of disease intensity and in both high and low levels of nitrogen but in a moderately resistant variety the loss was significant only at the highest level of disease intensity and high nitrogen level[3]. However, information about interaction of spacing with nitrogen application on the spread of the disease seems to be inadequate. Present study shows that although high nitrogen dose enhances the disease development, by transplanting seedlings 25 cm apart both ways, the intensity can be reduced to some extent.

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ON THE OCCURRENCE AND DISTRIBUTION OF ANGIOSPERMIC PARASITES IN ASSAM

THE common occurrence of angiospermic parasites in Assam *viz.*, Cuscuta reflexa Roxb. (Total stem parasite); *Cassytha filformis* L., *Dendropthe falcata* L.f. etting syn. *Loranthus longiflorus* Desr., *Tolypanthes involuckatcs* (Roxb). Van Tiegh Syn. *Loranthus involucratus* Roxb., *Scurrula parasitica* L. Syn. *Loranthus Scurrula* L, *Viscum monoicum* Roxb. (Total stem to taxonomists to study their mode of infection, Loeffl. (Total root parasites) offer an interesting field parasites); *Orobanche aegyptiaca* Pers. and *O. cernua* nutrition. nature of growth and distribution.

These different angiospermic parasites grow naturally on branches, twigs or roots of different hosts which may be of large or small trees, shrubs, herbs or climbers of the State. The extent of parasitism as well as the nature of distribution of *C. reflexa* Roxb. *D. falcata,* L. f. etting, *S. parasitica* L., etc., on different hosts has been studied by several workers [1,7,8,14,17] All these species described are indigenous throughout the State except *O. cernua* Loeffl. Kanjilal *et al*[9] also indicated the indigenous nature of these different types of stem parasites. Chaudhuri[3] showed the occurrence of only one species of *Cassytha* L. in Assam. However, stem parasites such as *C. reflexa* Roxb. *S. parasitica.* L, *D. falcata* L.f. etting, *V. monoicum,* Roxb. are widely distributed in Assam and more common than the other stem parasites; *C. filiformis* L. is rare whereas, root parasites, *O. cernua,* Loeffl. and *O. aegyptiaca* Pers. are seasonal and scarce.

Different hosts attacked by different angiospermic parasites have been observed and majority of the stem parasites parasitize different hosts as their natural habitats are. *Aegle marmelos* Corr, *Albizzia lucida* Benth, *A. procera* Benth, *Citrus decumena* L, *Dillenia indica* L., *Duranta plumieri* Jacq., *Erythrina indica* Lamk. *Ficus bengalensis* L., *F. religiosa* L., *Hydnocarpus kurzii* King, *Lagerstromia flos-reginae* Retz., *Mangifera indica* L., *Mimusops elengil* L, *Streblus asper* Lour, *Syzigium cuminii* Skeels, *Tamarindus indica* L., *Tectona granris,* Lf, *Vatica lanceaefolia* Bl, *Vitex negunda* L, *Zizyphus iujuba* Lamk etc., and of these *A. lucida* Benth. *D. indica* L, *D. plumieri* Jacq, *E. indica* L, *M. indica* L., are most common hosts of this locality and root parasites are found to parasitize the cultivated species, *viz. Brassica oleracea* L, *Nicotiana tabacum* L, *Solanum melongana* L. etc.

Investigations[1,2,7–12,14–16] which have been carried out on the occurrence of different types of hosts, parasitized by different angiospermic parasites. are in agreement with the present investigation in the majority of the cases and no detailed list therefore has been made to show their habitats. It is interesting to note that although these parasites have wide range of hosts covering about 58 families, no monocot host has been recorded in the present study.

As all these different types of species are generally ectoparasites, the environmental factors have profound influence on the growth and spreading habit, which keep a perfect relation with the harbouring hosts for continued advantage of water, organic and inorganic nutrients. Leafy misteloes, the members of the family Loranthaceae are most serious enemies in the Indian forests and orchards (Singh[15]). Kadafbi[8] stated that, *D. falcata* L. f. etting, a well recognised damaging agent to trees, cause more economic loss than any other phanerogamic parasites. Bhattacharya and Dutta[2] made some studies on the anatomical peculiarities of parasitic plants in relation to their hosts; Mukherjee and Bhattacharya[10] observed the evolution and phylogeny of the taxon *Cuscuta.* (Tourn) L.; Cronquist[4], Hutchinson[5], Kanjilal *et al.*[9], Johri and Tiagi[6], Prain[12], Santapau and Patel[13], and many others studied critically

TABLE I

Poisson distribution showing observed and expected values of the types of the angiospermic parasites

Plot No.	Freq.	0	1	2	3	4	Total	X 2 test	value of 'P'
1.	Obs.	12	7	1	0	..	20	0·90	
	Exp.	12·77	5·75	1·30	0·20	..	20·02	..	0·80
2.	Obs.	14	6	0	..	..	20	0·70	
	Exp.	14·81	4·43	0·67	..	..	19·91	..	0·50
3.	Obs.	15	5	0	..	..	20	0·80	
	Exp.	15·63	3·90	0·49	..	..	20·02	..	0·70
4.	Obs.	14	5	1	0	..	20	0·98	
	Exp.	14·10	4·94	0·86	0·10	..	20·00	..	0·95
5.	Obs.	17	3	0	..	..	20	0·90	
	Exp.	17·24	2·59	0·19	..	..	20·02	..	0·80
6.	Obs.	16	4	0	..	..	20	0·80	
	Exp.	16·39	3·27	0·32	..	..	19·98	..	0·70
7.	Obs.	16	3	1	0	..	20	0·90	
	Exp.	15·63	3·90	0·49	0·04	..	20·06	0·95	0·80
8.	Obs.	18	2	0	..	..	20		
	Exp.	18·18	1·82	0·09	..	..	20·09	..	
9.	Obs.	14	4	2	0	..	20	0·80	
	Exp.	13·41	5·36	1·17	0·16	..	20·10	..	0·70
10.	Obs.	11	8	1	0	..	20	0·80	
	Exp.	12·13	6·06	1·52	0·26	..	19·97	..	0·70
11.	Obs.	10	7	2	1	0	20	0·98	
	Exp.	9·96	6·97	2·45	0·56	0·05	19·99	..	0·95
12.	Obs.	16	4	0	..	..	20	0·80	
	Exp.	16·39	3·27	0·32	..	..	19·98	0·70	

taxonomic position of the taxon *Cuscuta* (Tourn.) L. However, no instance has hitherto been found on the nature of frequency distribution of parasitic angiosperms occurring on aerial parts of different hosts with the application of Poisson's rule. In the present work, a preliminary survey of the occurrence of the stem and root parasites mentioned above was conducted (during 1974–75) and a brief account of the study on the distribution of the stem parasites in roadsides and thin forests has been made.

Some plots were randomly selected and used for 20 hosts (giving little importance on the specificity of the hosts) at 1% level from each plot. Here, the single host tree was considered as "Quadrat" and the number of occurrence of the types of stem parasites (either total or partial) found in each host were recorded and their nature of distribution was studied applying the Poisson's rule (Table I).

From Table I, it is observed that the mode of occurrence and distribution of the types of parasites in different hosts of the experimental plots follow the Poisson's rule with different probability values and found to be good fit statistically in all cases which may probably be due to the nature of infection and growth of the parasites and their nutritional behaviour.

Thus, from the foregoing account, it is evident that the types of parasites occurring on aerial parts of different hosts are distributed in accordance with Poisson's probability rule.

Thanks are due to Dr. H. K. Baruah, Vice-Chancellor, Gauhati University, for his encouragement and valuable suggestions and to Dr. D. Banerjee, Senior Palynollogist, O.N.G.C., Sibsagar, for his kind help and encouragement.

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FACTORS RESPONSIBLE FOR THE MODE OF ACTION OF POLYHEDRAL INCLUSION BODIES OF THE NUCLEAR POLYHEDROSIS VIRUS IN THE TOBACCO CATERPILLAR *SPODOPTERA LITURA* F.

ESTES AND FAUST[1] have reported the presence of silicon in the polyhedral inclusion bodies (PIB) and suggested that the silicon along with magnesium and ferric ions may be responsible for the stability of the polyhedra. These ions form the skeletal lattice framework on which protein is deposited during the formation of nuclear polyhedrosis viruses (NPV) of PIB. The effect of various dilute alkaline solutions on the dissolution and release of the virions initially, from their polyhedral protein shell is reported by Hughes[2]. Further evidence indicates that polyhedral protein is not digested by the usual proteolytic enzymes prior to alkaline pre-treatment[3]. It appears therefore that the mode of action of polyhedral inclusion viruses in insects, in part is associated with certain chemical constituents of the inclusion bodies themselves, and to a certain extent, depends on intrinsic properties of the intestinal gut contents like pH, alkaline constituents and proteolytic enzymes present in the gut system of host insect. In the present study, the possible mode of action of NPV of tobacco caterpillar, *Spodoptera litura* is reported from the above points of view.

The inclusion bolies were concentrated and purified from the diseased larvae of *S. litura* by differential centrifugation. The concentrated polyhedra were dried and samples of 50 mg each in three replicates were used for the estimation of silicon content. Silicon content was determined as described by Volk and Weintraub[4] using ammonium molybdate and *p*-methyl-amino phenol sulphate as reducing solution. The concentration of silicon was calculated from sodium silicate used for the preparation of the standard curve.

Estimation of alkaline components, *viz.*, carbonate and bicarbonate was made by titrimetry[5] from the supernatant fluid of gut juice, obtained after maceration and centrifugation of midgut portions of *S. litura*. The pH of midgut and haemolymph of the larvae was determined using both wide and narrow range (BDH) pH papers.

The mode of action of NPV in insects is generally attributed to the release of virions from the poyhedral protein matrix into the gut lumen by the action of enzymes. The pathogen penetrates the gut wall and infects almost all organs in the haemocoel. Since Bergold[3] has reported that the polyhedral protein is not affected by proteolytic enzymes like pepsin, trypsin and papain, the digestion and dissolution of PIB in the gut system were questioned. It was found in the present study that silicon was present in the intact PIB of NPV of *S. litura* to the extent of 0·15% of the total dry weight of polyhedra. Earlier studies by Holoway and Belgold[6,7] revealed the presence of Mg^{++} and Fe^{++} in the PIB. It is evident from the results now presented that polyhedra contain appreciable amounts (0·15%) of silicon. Thus the four negatively charged units of orthosilicate SO_4^{4-} were balanced by the four posiiivity charged ions of Mg^{++} and Fe^{++}. This constitutes the siliceous framework of the polyhedral protein matrix accounting for its non-digestibility prior to alkaline treatment[1]. The presence of silicon as one of the major elements in intact polyhedra, of the virus is in conformity with the earlier reports[1,8,9].

The pH of midgut of *S. litura* is alkaline (8·2–8·5) when oompared with that of haemolymph (6·4–6·7) which is near neutral. Bicarbonate is present in the gut secretions (0·03 m.eq.); no carbonate could be detected.

It is believed that the true infective unit in the NPV of the insects is the virion comprising DNA protected by the protein coat. The infection by NPV and their invasion in insects is primarily due to the initial digestion and dissolution of polyhedral protein coat by the non-enzymatic alkaline gut contents. In an earlier report, Pawar and Ramakrishnan[10] showed