development of embryo sac haustoria from the middle of the embryo sac is recorded for the first time.

The integumentary tapetum, which is uniseriate with uninucleate cells, differentiates at the megaspore tetrad stage In *E. echinatus*, the development of the embryo sac is of the polygonum type. The young embryo sac is spindle-shaped (figure 2). Synergids are without hooks. The antipodal cells are uninucleate and three in number During organization the wall of the embryo sac is smooth and more or less abuts the inner wall of the integumentary tapetum (figure 2). Later the embryo sac becomes broader at the centre and remains narrow at both the ends (figure 3). At this stage from the middle of the embryo sac on either side small finger-like protuberances appear and protrude into the integumentary tapetal cells. Gradually these protuberances invade the tapetal cells, absorb their contents and finally obliterate them. The accumulation of dense cytoplasm in these protuberances as well as in the embryo sac and the depleted contents of the obliterated cells of the integumentary tapetum and surrounding tissue indicate the haustorial nature of these protuberances. Simultaneously from the synergids and also from the antipodal cells haustorial processes develop towards the micropylar and chalazal regions of the embryo sac respectively. From the tip of the synergids small narrow protuberances intrude into the micropyle. Gradually they become long haustorial structures invading the tissue on either side of the micropyle. However, one of the synergid haustoria (figure 4) is aggressive and forms a tubular structure destroying and absorbing the contents of the integumentary tissue on either side, while the other synergid haustorium remains behind and is not so aggressive.

Of the three antipodal cells the upper one elongates and becomes somewhat curved (figure 3). It grows downward, crushes the other two antipodal cells and thereby makes its way into the chalazal tissue. Finally this antipodal cell becomes the haustorium (figure 5), which not only crushes and absorbs the integumentary tapetal cells adjoining it but also crushes and absorbs the contents of the chalazal tissue Because of these haustoria the surrounding cells of the integumentary tapetum become distorted in their shape and depleted of their contents. The ovular tissue around the embryo sac forms a pseudoperiendothelial zone (figure 3). Thus in *E. echinatus* the occurrence of embryo sac haustoria besides antipodal and synergid haustoria is recorded for the first time.

In Asteraceae, in a few cases such as *Calotis lappulacea*[1], *C. cuneifolia*[2] and *Melampodium divaricatum*[3] the embryo sacs become elongated and protrude into or beyond the micropyle as a rare feature. But in none of the cases the direct haustorial activity of the embryo sac wall is recorded. Such instances have not been hitherto reported even in the closely related families of Asteraceae. In most other members where embryo sac haustorium is present usually it is reported as a caecum-like structure. The presence of such finger-like outgrowths from the middle of the embryo sac wall is reported in *Exocarpus strictus*[4]. This particular type of embryo sac haustoria is known to occur only in this parasitic member of Santalaceae which may be regarded as an efficient method to provide nutrition to the developing female gametophyte and embryo. Likewise in *E. echinatus* also the occurrence of embryo sac haustoria may be correlated with nutritional function in view of the xeric habitat. Probably in this plant also the embryo sac haustoria from the middle region besides synergid and antipodal haustoria may be regarded as a special device to provide nutrition to the developing female gametophyte, so as to ensure increased fertility and seed set. In the absence of relevant literature indicating a possible correlation between the xeric habitat of the plant and the development of the embryo sac haustoria, it is suggested that further investigations in this direction could be of some use in elucidating the behaviour of female gametophyte under water stress

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A POTENT SYSTEMIC INHIBITOR OF PLANT VIRUS INFECTION FROM *AERVA SANUGUINOLENTA* BLUME

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PLANTS belonging to Centrospermae are well known to contain substances which inactivate the virus or interfere with its establishment/multiplication[1-5]. In

this communication, the antiviral activity of the crude extract of *Aerva sanguinolenta* (AS) a member of family Amaranthaceae, is reported in different host-virus combinations.

Maintenance of virus culture and test plants, preparation of inoculum and method of virus inoculation were essentially the same as described earlier[1].

Antiviral activity of the extract was studied in the following three ways:

(i) *Incubation of virus inoculum with AS extract*

Virus inoculum was mixed with an equal volume of AS extract, incubated for 30 min and thereafter tested for viral activity. Plants of similar size and age, inoculated with 1:1 mixture of virus inoculum and distilled water were maintained as control for comparison.

(ii) *Pre-inoculation treatment*

Basal leaves of test plants were treated with AS extract and after specified period both basal and upper leaves (untreated) were challenge-inoculated with the virus. Plants serving as control were treated with distilled water (basal leaves) and challenge-inoculated with virus in similar manner.

(iii) *Post inoculation treatment*

Plants were first inoculated with virus and after specified periods treated with the AS extract. Suitable control was maintained simultaneously.

To know the time required for the movement of active antiviral principle from lower treated to upper untreated leaves; basal leaves of test plants were treated with AS extract or distilled water. Later these leaves were removed at different intervals after treatment. Virus was challenged in the top leaves 24 hr after treatment with AS extract in lower leaves. Movement of inhibitory stimulus from treated to non-treated leaves was estimated by noting the reduction in local lesions in non-treated leaves as compared to control leaves where basal leaves were treated with distilled water at different intervals before virus challenge.

Percent inhibition in all the experiment was calculated by the formula $(C-T)/C \times 100$.

Leaves of *A. sanguinolenta* contained a potent inhibitor of plant virus infection. Leaf extract when mixed with the virus inoculum caused 97-100% inhibition in all the host virus combinations tested (table 1). A high degree of resistance to infection in treated and non-treated leaves (80–100% reduction in lesion number) was also observed when CT, or DS plants were mechanically inoculated with SRV or TMV 1–7 days after treatment. In other host virus combinations (NR-TMV; NG-TMV, NT-TMV) the inhibitory effect although quite con-

Table 1 *Effect of Aerva sanguinolenta* (AS) *extract on virus infectivity when mixed with virus inoculum* (1:1)

Host-virus combination	Percent inhibition
Nicotiana glutinosa: TMV	97
Cyamopsis tetragonoloba: SRV	100
Datura stramonium: TMV	100
D. metel: TMV	100
N. tabacum variety Samsan NN	100

TMV = Tobacco mosaic virus; SRV = Sunhemp rosette virus

Table 2 *Effect of pre-inoculation treatment with Aerva sanguinolenta* (AS) *extract* (1:1) *on percent virus inhibition in a few host virus combinations*

Host-virus combination	Treatment at different intervals before virus challenge (in-days)	Percent inhibition: In treated leaves	Percent inhibition: In non-treated leaves
CT-SRV	1–7	99	90
	8	90	81
	9	90	78
	10	88	62
	11	80	50
	12	73	43
DS-TMV	1	100	100
	2	100	100
	3	100	99
	4	90	96
	5	88	80
	6	88	80
NT var Samsun NN-TMV	1	68	65
	2	70	68
	3	69	72
NR-TMV	1	80	76
	2	80	80
	3	82	86
NG-TMV	1	68	41
	2	69	44
	3	71	82
CA TMV	1	S	S

S = Number of lesions more than control; CA = *Chenopodium amaranticolor*; CT = *Cyamopsis tetragonoloba*; DS = *Datura stramonium*; NG = *Nicotiana glutinosa*; NR = *Nicotiana rustica*; NT = *N. tabacum*, TMV = Tobacco mosaic virus; SRV = Sunhemp rosette virus.

Table 3 *Effect of detaching lower leaves following treatment with Aerva sanguinolenta (AS) extract at various intervals on the production of local lesions in upper leaves*

*Lower leaves treated with AS extract, or DW and detached after different intervals	†Average number of local lesions/leaf	
	Treated with water (control)	Treated with AS
5 min	101	83
1 hr	134	64
2 hr	106	33
4 hr	104	18
8 hr	250	11
10 hr	155	5
24 hr	160	1

*Virus (SRV) was inoculated in the top leaves after 24 hr treatment of lower leaves with AS extract.
†Average number of local lesions on 10 leaves of *Cyamopsis tetragonoloba*.

siderable was not so high. In CA-TMV combination, no antiviral effect was noticed (table 2).

The inhibitory stimulus of AS leaf extract could move from treated to untreated leaf of the same plant within an hour after application (table 3). However, the movement sufficient to cause more than 90% inhibition required about 4 hr.

Thus, resistance to virus infection induced by AS extract is systemic and of long duration. Investigations are in progress to isolate and identify the antiviral principle and study its mechanism of action.

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A NEW GENUS AND SPECIES OF FERN INFESTING THRIPS (*THYSANOPTERA: INSECTA*) WITH FURTHER NOTES ON *MYCETEROTHRIPS NILGIRIENSIS* (ANAN.)

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SPORANGIOTHRIPS Genus Novo

Head *Anascirtothrips*-like, transverse, slightly produced in front of eyes in the form of an interantennal projection separating the antennal bases. Antenna thin and slender, seven-segmented, with long, slender, forked, sense cones on segments 3 and 4; segment 2 barrel-shaped; segment 7 forming a very long style, very much longer than segment 6. Eyes very large, larger than cheeks. Mouth cone broad across basal third, tending to be triangular, almost reaching the posterior margin of the pronotum; maxillary palp 3-segmented. Pronotum longer and wider than head, with two pairs of postangulars, the outer longer than the inner, posteromarginals absent; metathoracic furcula distinctly 'vase' shaped; mesothoracic furcula absent. Fore wings with numerous microsetulae, upper vein with four scattered short setae, two at base, one at the distal one third, and one at apex; lower vein absent. Abdomen without fine microsetulae; segment IX of abdomen with well developed setae, B_1, B_2, B_3, and segment X with B_1 and B_2.

Genus type: *Sporangiothrips acuminatus* gen. et. sp. nov.

This new genus approaches *Anascirtothrips*[1] in general body build, head structure and the number of antennal segments, but is distinguished from it by the presence of two pairs of conspicuous postangulars, absence of densely set rows of fine microsetulae on the abdomen, specialised furcula on the metathorax and also by the nature of the antenna. In *Anascirtothrips* antennal segment 7, forming the style is shorter than the segment 6, but in this new genus the antennal segment 7 is very much longer than segment 6. The nature of antennal segments 3 and 4 is also completly different from those of *Anascirtothrips*. In *Anascirtothrips* the sense cones though forked, are stout, whereas in this genus they are also forked, but long and slender. This genus has only the upper vein in the fore wing, with only four scattered setae.

Sporangiothrips acuminatus sp. nov.

Female (Macropterous): General body colour