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EVALUATION OF SUNFLOWER GERMPLASMS FOR STEM BORER [*Nupserha* sp. near *vexator* (Pascoe)] RESISTANCE

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SUMMARY

As many as 251 insect and acarid species are known to attack sunflower crop worldwide. Recently, a stem borer has emerged as a new and regular pest of sunflower in Marathwada region (M.S.) India. It is a coleopterous grub *Nupserha* sp. near *vexator* (Pascoe), which belongs to the family *Cerambycidae*: *Lamiinae*. Hence, the screening of sunflower germplasm lines was conducted during last five years to identify resistance sources against stem borer for further exploitation in breeding programs. A set of 100 germplasm lines was annually received from All-India Coordinated Research Project on Sunflower during 2002-06 to evaluate sources of resistance for major sunflower pests. The screening work was carried out at Oilseeds Research Station, Latur, M.S., India, which was identified as a hotspot for stem borer in sunflower. Reactions to stem borer received from the germplasm lines were categorized for ease in evaluation of resistance potential of each test line. Stem borer incidence varied from free to >80% in the germplasm under investigation during last five years indicating the presence of adequate variability in the material for their response to stem borer infestation.

Key words: sunflower, germplasm, stem borer, incidence, resistance

INTRODUCTION

Several species of both beneficial and harmful insects as well as microbial organisms are associated with sunflower (*Helianthus annuus* L.) crop. Among biotic constraints in sunflower production, insect pests and diseases are of major concern. Among harmful insects, seedling insect pests, capitulum borers and defoliators are considered as insect pests of economic importance. Among the defoliators, the tobacco caterpillar, the Bihar hairy caterpillar, the green semilooper and the cabbage green semilooper are of major importance. The army worm, the saf-

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flower caterpillar, the tea caterpillar, weevils and grasshoppers are the defoliators of major importance. The loss in seed yield due to defoliators in a rain-fed *kharif* crop was up to 268 kg/ha recorded at Bangalore, (K.S.) India. Outbreaks of *Spodoptera litura* have been noticed in sunflower-growing areas of Karnatka and Maharashtra State of India. The capitulum borer (*Helicoverpa armigera*) is the most serious and destructive pest of all insect pests of sunflower (Anonymous[1], 2006). As many as 251 insect and acarid species are known to attack sunflower crop worldwide (Rajamohan, 1976). Recently, a stem borer has emerged as a new pest of sunflower in Marathwada region (M.S.), India. It is a coleopterous grub, *Nupserha* sp. near *vexator* (Pascoe), which belongs to the family *Cerambycidae*: *Lamiinae*. Severe incidence up to 70% of stem borer was observed in farmers' fields during a survey of kharif sunflower in Latur district of Marathwada region (Anonymous, 1998). Incidence of stem borer in farmers' fields in July-sown crop was 42-55% whereas up to 25% incidence was recorded in August-sown crop during a pest survey in Marathwada region (Anonymous, 2001). Stem borer incidence was recorded to the extent 25% at Ambulga in Latur district (Anonymous, 2004) and 10-25% incidence was reported for most of the locations of Latur district (Anonymous[2], 2006). Therefore, germplasm sunflower lines were screening during last five years to identify resistance sources against stem borer for further exploitation in breeding programs.

MATERIAL AND METHODS

A set of 100 germplasm lines from All-India Coordinated Research Project on Sunflower was received per year during 2002-06 to evaluate sources of resistance for major pests of sunflower. The screening work was carried out at Oilseeds Research Station, Latur, M.S., India, which was identified as a hotspot for stem borer in sunflower. In order to generate information on potential donors for stem borer resistance, the present study was conducted during 2002-06. A total of 500 germplasm lines have been screened in the last five years. One hundred test lines were sown per year in *kharif* season (July-August sowing) in a single row of 4.2 m length with the spacing of 60 × 30 cm. All recommended agronomic practices were followed. Observations were made at the time of harvest by cutting the stem at the collar region. The percent incidence was worked out on the basis of the number of plants infested by stem borer in each test line. The data generated during the last five years are presented in Tables 1 to 5.

RESULTS

Reactions to the stem borer (*N. vexator*) in sunflower germplasm lines were categorized for ease in evaluation of resistance potential of each test line. The lines that showed zero reaction to the stem borer were categorized as highly resistant, the

Table 1: Germplasm lines tested during *kharif*, 2002

Entry	% SB incidence	Entry	% SB incidence
GMU-01	18.0	GMU-51	25.0
GMU-02	33.0	GMU-52	36.0
GMU-03	18.0	GMU-53	50.0
GMU-04	8.0	GMU-54	33.0
GMU-05	20.0	GMU-55	54.0
GMU-06	25.0	GMU-56	50.0
GMU-07	33.0	GMU-57	33.0
GMU-08	25.0	GMU-58	22.0
GMU-09	36.0	GMU-59	36.0
GMU-10	33.0	GMU-60	50.0
GMU-11	20.0	GMU-61	27.0
GMU-12	40.0	GMU-62	42.0
GMU-13	25.0	GMU-63	30.0
GMU-14	33.0	GMU-64	22.0
GMU-15	42.0	GMU-65	27.0
GMU-16	27.0	GMU-66	25.0
GMU-17	50.0	GMU-67	33.0
GMU-18	29.0	GMU-68	50.0
GMU-19	0.0	GMU-69	36.0
GMU-20	33.0	GMU-70	50.0
GMU-21	27.0	GMU-71	11.0
GMU-22	22.0	GMU-72	18.0
GMU-23	13.0	GMU-73	33.0
GMU-24	18.0	GMU-74	18.0
GMU-25	25.0	GMU-75	33.0
GMU-26	18.0	GMU-76	25.0
GMU-27	11.0	GMU-77	36.0
GMU-28	10.0	GMU-78	40.0
GMU-29	36.0	GMU-79	33.0
GMU-30	30.0	GMU-80	44.0
GMU-31	33.0	GMU-81	38.0
GMU-32	25.0	GMU-82	27.0
GMU-33	18.0	GMU-83	42.0
GMU-34	25.0	GMU-84	36.0
GMU-35	33.0	GMU-85	33.0
GMU-36	33.0	GMU-86	22.0
GMU-37	33.0	GMU-87	18.0
GMU-38	18.0	GMU-88	0.0
GMU-39	33.0	GMU-89	50.0
GMU-40	54.0	GMU-90	33.0
GMU-41	25.0	GMU-91	27.0
GMU-42	18.0	GMU-92	44.0
GMU-43	27.0	GMU-93	45.0
GMU-44	25.0	GMU-94	38.0
GMU-45	33.0	GMU-95	33.0
GMU-46	36.0	GMU-96	42.0
GMU-47	30.0	GMU-97	36.0
GMU-48	45.0	GMU-98	0.0
GMU-49	55.0	GMU-99	10.0
GMU-50	36.0	GMU-100	18.0

Table 2: Germplasm lines tested during *kharif*, 2003

Entry	% SB incidence	Entry	% SB incidence
GMU-101	16.6	GMU-151	15.3
GMU-102	30.7	GMU-152	21.4
GMU-103	27.2	GMU-153	18.1
GMU-104	28.5	GMU-154	21.4
GMU-105	7.1	GMU-155	28.5
GMU-106	14.2	GMU-156	27.2
GMU-107	21.4	GMU-157	38.4
GMU-108	14.2	GMU-158	14.2
GMU-109	28.5	GMU-159	7.6
GMU-110	14.2	GMU-160	28.5
GMU-111	25.0	GMU-161	15.3
GMU-112	15.3	GMU-162	7.6
GMU-113	8.3	GMU-163	0.0
GMU-114	14.2	GMU-164	18.1
GMU-115	8.3	GMU-165	21.4
GMU-116	7.6	GMU-166	9.0
GMU-117	21.4	GMU-167	28.5
GMU-118	15.3	GMU-168	15.3
GMU-119	14.2	GMU-169	25.0
GMU-120	14.2	GMU-170	33.3
GMU-121	14.2	GMU-171	14.2
GMU-122	21.4	GMU-172	16.6
GMU-123	15.3	GMU-173	21.4
GMU-124	45.4	GMU-174	15.3
GMU-125	0.0	GMU-175	25.0
GMU-126	33.3	GMU-176	28.5
GMU-127	14.2	GMU-177	16.6
GMU-128	50.0	GMU-178	8.3
GMU-129	16.6	GMU-179	23.0
GMU-130	20.0	GMU-180	16.6
GMU-131	36.3	GMU-181	7.6
GMU-132	16.6	GMU-182	21.4
GMU-133	23.0	GMU-183	16.6
GMU-134	16.6	GMU-184	15.3
GMU-135	20.0	GMU-185	21.4
GMU-136	14.2	GMU-186	30.7
GMU-137	16.6	GMU-187	21.4
GMU-138	25.0	GMU-188	14.2
GMU-139	23.0	GMU-189	21.4
GMU-140	25.0	GMU-190	28.5
GMU-141	14.2	GMU-191	15.3
GMU-142	8.3	GMU-192	15.3
GMU-143	36.3	GMU-193	25.0
GMU-144	20.3	GMU-194	30.7
GMU-145	45.4	GMU-195	23.0
GMU-146	18.1	GMU-196	14.2
GMU-147	15.3	GMU-197	35.7
GMU-148	18.1	GMU-198	28.5
GMU-149	28.6	GMU-199	15.3
GMU-150	25.0	GMU-200	23.0

incidence <10% was categorized as resistant, <15% as moderately resistant, <20% as low resistant, <30% as tolerant, between 30 and 50% to be discourage for further exploitation and the incidence >50% was treated as susceptible. The response of set I of germplasm lines presented in Table 1 revealed that GMU-19, 88 and 98 were highly resistant, GMU-04, 28 and 99 were resistant, GMU-23, 27 and 71 were moderately resistant, whereas GMU-01, 03, 24, 26, 33, 42, 72, 74, 87 & 100 were evaluated as low resistant to stem borer. The following 25 lines were found to be tolerant: GMU-06, 08, 13, 16, 18, 21, 22, 25, 30, 32, 34, 41, 43, 44, 47, 51, 58, 61, 64, 65, 66, 76, 82, 86 and 91, and the following 9 lines showed susceptible reactions: GMU 17, 49, 53, 55, 56, 60, 68, 70 and 89. Set II of 100 germplasm lines screened during *kharif* 2003 against stem borer (Table 2) showed that 34 lines were tolerant to the stem borer, GMU-103, 104, 107, 109, 114, 117, 122, 133, 138, 139, 140, 149, 150, 152, 154, 155, 156, 160, 165, 167, 169, 173, 175, 176, 179, 182, 185, 187, 189, 190, 193, 195, 198 and 200, 26 lines were evaluated as low resistant to the stem borer, GMU-112, 118, 123, 129, 130, 132, 134, 135, 137, 146, 147, 148, 151, 153, 161, 164, 168, 172, 174, 177, 180, 183, 184, 191, 192 and 199. Twelve lines were moderately resistant, GMU-110, 114, 119, 120, 121, 127, 136, 141, 158, 171, 188 and 196. Nine lines were resistant, GMU-113, 115, 116, 142, 159, 162, 166, 178 and 181, whereas GMU-125 and 163 were evaluated as highly resistant. GMU-128 was the only line that recorded high incidence of the pest, to the extent of 50%. Set III of sunflower germplasm was tested in 2004. The data presented in Table 3 show that GMU 265, 279 and 288 were highly resistant to the stem borer but it is interesting that no entry emerged as resistant. GMU-256 and 299 showed moderate resistance to the stem borer whereas GMU 245 & 273 were low resistant. Eleven lines, GMU 215, 226, 228, 230, 239, 258, 262, 275, 276, 280 and 292, were tolerant to the stem borer. The highest incidence among the 100 lines, >70%, was recorded in GMU-274, 285 and 286. Set IV of sunflower germplasm was sown in *kharif*, 2005 and the results reported in Table 4 indicate that the incidence of stem borer reached its peak in that year, >80%. The highest incidence was recorded in GMU 351, 358 and 360. On the other hand, GMU-400 showed zero reaction to stem borer. GMU-335, 369 and 373 showed resistance to the stem borer while GMU-304, 312, 328 and 389 were moderately resistant. GMU-327, 357 and 394 were in the low resistant category and GMU- 310, 313, 314, 315, 318, 320, 321, 322, 329, 333, 338, 345, 347, 348, 352, 355, 364, 376, 376, 377, 381, 392, 393, 398 and 399 were in the tolerant category. Set V of sunflower germplasm was screened during *kharif*, 2006 and data generated and presented in Table 5 show that the incidence of the stem borer was in the range from free to 50%. Of the 100 lines tested, GMU 459, 480 and 488 were highly resistant to the stem borer as they remained totally free from infestation, while GMU 500 was recorded as having high incidence of the pest, to the extent if 50%. Among the 100 lines tested, 6 were resistant, GMU 431, 439, 444, 453, 464 and 482, 14 were moderately resistant, GMU-410, 433, 438, 445, 452, 457, 458, 465, 472, 475, 483,

Table 3: Germplasm lines tested during *kharif*, 2004

Entry	% SB incidence	Entry	% SB incidence
GMU-201	38.0	GMU-251	55.0
GMU-202	33.0	GMU-252	55.0
GMU-203	40.0	GMU-253	33.0
GMU-204	33.0	GMU-254	40.0
GMU-205	PG	GMU-255	43.0
GMU-206	45.0	GMU-256	14.0
GMU-207	57.0	GMU-257	40.0
GMU-208	63.0	GMU-258	25.0
GMU-209	38.0	GMU-259	33.0
GMU-210	50.0	GMU-260	50.0
GMU-211	42.0	GMU-261	33.0
GMU-212	40.0	GMU-262	29.0
GMU-213	33.0	GMU-263	52.0
GMU-214	50.0	GMU-264	33.0
GMU-215	25.0	GMU-265	0.0
GMU-216	43.0	GMU-266	57.0
GMU-217	50.0	GMU-267	38.0
GMU-218	40.0	GMU-268	67.0
GMU-219	33.0	GMU-269	50.0
GMU-220	63.0	GMU-270	50.0
GMU-221	50.0	GMU-271	60.0
GMU-222	66.0	GMU-272	50.0
GMU-223	50.0	GMU-273	17.0
GMU-224	50.0	GMU-274	71.0
GMU-225	40.0	GMU-275	22.0
GMU-226	22.0	GMU-276	28.0
GMU-227	38.0	GMU-277	44.0
GMU-228	22.0	GMU-278	44.0
GMU-229	44.0	GMU-279	0.0
GMU-230	25.0	GMU-280	25.0
GMU-231	50.0	GMU-281	66.0
GMU-232	40.0	GMU-282	63.0
GMU-233	66.0	GMU-283	66.0
GMU-234	50.0	GMU-284	57.0
GMU-235	50.0	GMU-285	75.0
GMU-236	66.0	GMU-286	77.0
GMU-237	45.0	GMU-287	50.0
GMU-238	44.0	GMU-288	0.0
GMU-239	29.0	GMU-289	43.0
GMU-240	60.0	GMU-290	38.0
GMU-241	66.0	GMU-291	50.0
GMU-242	45.0	GMU-292	30.0
GMU-243	50.0	GMU-293	50.0
GMU-244	40.0	GMU-294	45.0
GMU-245	20.0	GMU-295	50.0
GMU-246	50.0	GMU-296	50.0
GMU-247	55.0	GMU-297	33.0
GMU-248	38.0	GMU-298	57.0
GMU-249	63.0	GMU-299	14.0
GMU-250	57.0	GMU-300	33.0

Table 4: Germplasm lines tested during *kharif*, 2005

Entry	% SB incidence	Entry	% SB incidence
GMU-301	50.0	GMU-351	80.0
GMU-302	73.0	GMU-352	30.0
GMU-303	33.0	GMU-353	60.0
GMU-304	11.0	GMU-354	64.0
GMU-305	44.0	GMU-355	25.0
GMU-306	44.0	GMU-356	45.0
GMU-307	42.0	GMU-357	20.0
GMU-308	31.0	GMU-358	80.0
GMU-309	50.0	GMU-359	36.0
GMU-310	22.0	GMU-360	80.0
GMU-311	50.0	GMU-361	50.0
GMU-312	14.0	GMU-362	66.0
GMU-313	30.0	GMU-363	66.0
GMU-314	25.0	GMU-364	25.0
GMU-315	22.0	GMU-365	
GMU-316	36.0	GMU-366	66.0
GMU-317	33.0	GMU-367	43.0
GMU-318	29.0	GMU-368	50.0
GMU-319	45.0	GMU-369	10.0
GMU-320	25.0	GMU-370	54.0
GMU-321	30.0	GMU-371	58.0
GMU-322	27.0	GMU-372	60.0
GMU-323	45.0	GMU-373	10.0
GMU-324	55.0	GMU-374	PG
GMU-325	32.0	GMU-375	54.0
GMU-326	60.0	GMU-376	25.0
GMU-327	20.0	GMU-377	25.0
GMU-328	15.0	GMU-378	31.0
GMU-329	25.0	GMU-379	50.0
GMU-330	52.0	GMU-380	PG
GMU-331	35.0	GMU-381	22.0
GMU-332	30.0	GMU-382	54.0
GMU-333	29.0	GMU-383	PG
GMU-334	45.0	GMU-384	45.0
GMU-335	9.0	GMU-385	73.0
GMU-336	38.0	GMU-386	45.0
GMU-337	46.0	GMU-387	60.0
GMU-338	29.0	GMU-388	38.0
GMU-339	64.0	GMU-389	14.0
GMU-340	55.0	GMU-390	42.0
GMU-341	40.0	GMU-391	38.0
GMU-342	38.0	GMU-392	27.0
GMU-343	50.0	GMU-393	25.0
GMU-344	56.0	GMU-394	20.0
GMU-345	22.0	GMU-395	36.0
GMU-346	57.0	GMU-396	33.0
GMU-347	25.0	GMU-397	33.0
GMU-348	25.0	GMU-398	25.0
GMU-349	60.0	GMU-399	29.0
GMU-350	31.0	GMU-400	0.0

484, 494 and 495, and 15 lines showed low resistance to the stem borer, GMU-401, 408, 412, 426, 435, 440, 441, 474, 477, 481, 485, 487, 489, 490 and 493. The tolerant category included 14 lines, GMU-402, 403, 409, 414, 436, 451, 454, 456, 461, 462, 463, 473, 478 and 499.

Table 5: Germplasm lines tested during *kharif*, 2006

Entry	% SB incidence	Entry	% SB incidence	Entry	% SB incidence	Entry	% SB incidence
GMU-401	16.6	GMU-426	DS	GMU-451	22.2	GMU-476	33.0
GMU-402	25.0	GMU-427	DS	GMU-452	11.0	GMU-477	20.0
GMU-403	28.6	GMU-428	20	GMU-453	9.1	GMU-478	23.1
GMU-404	PG	GMU-429	DS	GMU-454	30.0	GMU-479	33.0
GMU-405	41.6	GMU-430	DS	GMU-455	33.2	GMU-480	0.0
GMU-406	PG	GMU-431	8.3	GMU-456	22.2	GMU-481	18.0
GMU-407	PG	GMU-432	DS	GMU-457	12.5	GMU-482	10.0
GMU-408	16.6	GMU-433	14.3	GMU-458	11.0	GMU-483	11.0
GMU-409	28.5	GMU-434	PG	GMU-459	0.0	GMU-484	14.3
GMU-410	14.3	GMU-435	20.0	GMU-460	DS	GMU-485	16.6
GMU-411	PG	GMU-436	28.5	GMU-461	23.1	GMU-486	37.5
GMU-412	16.6	GMU-437	DS	GMU-462	25.0	GMU-487	20.0
GMU-413	PG	GMU-438	11.0	GMU-463	25.0	GMU-488	0.0
GMU-414	25.0	GMU-439	10.0	GMU-464	9.1	GMU-489	16.6
GMU-415	PG	GMU-440	20.0	GMU-465	14.3	GMU-490	20.0
GMU-416	PG	GMU-441	20.0	GMU-466	DS	GMU-491	_
GMU-417	PG	GMU-442	DS	GMU-467	DS	GMU-492	33.0
GMU-418	PG	GMU-443	DS	GMU-468	DS	GMU-493	16.6
GMU-419	PG	GMU-444	10.0	GMU-469	DS	GMU-494	14.3
GMU-420	PG	GMU-445	14.3	GMU-470	DS	GMU-495	11.0
GMU-421	PG	GMU-446	DS	GMU-471	DS	GMU-496	40.0
GMU-422	DS	GMU-447	DS	GMU-472	11.0	GMU-497	DS
GMU-423	DS	GMU-448	DS	GMU-473	27.3	GMU-498	DS
GMU-424	DS	GMU-449	DS	GMU-474	16.6	GMU-499	28.6
GMU-425	DS	GMU-450	DS	GMU-475	12.5	GMU-500	50.0

SB-stem borer, PG-poor germination,
DS-disease susceptible (wiped out with disease either by downy mildew, necrosis or both)

DISCUSSION

Stem borer incidence varied from free to >80% in the germplasm under investigation during last five years indicating the presence of adequate variability in the material for their response to stem borer infestation. Anonymous (2001) reported that out of 50 germplasm lines of sunflower screened for stem borer resistance, 22 were found free from stem borer, one line, Acc. No. 210, recorded the incidence <10%, nine entries showed the incidence <15%, 13 lines recorded the incidence

below 20%, 11 lines showed tolerance to stem borer, *i.e.*, the incidence <30% and 5 lines were 100% susceptible to the stem borer. Anonymous (2002) reported that among 96 sunflower germplasm lines evaluated for stem borer resistance, 12 lines showed resistance to the stem borer, *i.e.*, the incidence <10%, 30 lines were <20% and 19 lines were infected below 30%. Three lines registered the incidence of stem borer to the extent 60%.

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EVALUACIÓN DE GERMOPLASMA DE GIRASOL POR RESISTENCIA A BARRENADOR DEL TALLO [(*Nupserha* sp. near *vexator* (Pascoe)]

RESUMEN

A lo largo del mundo, existen 251 especies de insectos ácaros que se sabe atacan al girasol. Actualmente el barrenador del tallo emerge como una peste nueva y regular para girasol en la región de Marathwada (M.S.) India. Es una larva de coleóptero perteneciente a la especie *Nupserha* sp. near *vexator* (Pascoe) y pertenece a la familia *Cerambycidae*: *Lamiinae*. Durante los últimos cinco años se evaluaron líneas de girasol con el objetivo de identificar fuentes de resistencia al barrenador del tallo para su posterior utilización en programas de mejoramiento. Durante los años 2002/2006 se recibieron cien líneas del programa de investigación coordinado All India para evaluar fuentes de resistencia a las principales pestes del girasol. El trabajo de evaluación se llevó a cabo en la Oilseeds Research Station, Latur, M.S., India, identificado como un ambiente de alta infestación del barrenador del tallo de girasol. Las reacciones recibidas de las líneas contra el barrenador del tallo se categorizaron por su facilidad de evaluación del potencial de resistencia de cada línea. La incidencia del barrenador del tallo varió desde cero ataque a más de 80% en el

germoplasma bajo investigación durante los cinco años, lo que indica la presencia de variabilidad adecuada en este material en términos de su respuesta a la infestación con barrenador del tallo.

ÉVALUATION DE LA RÉSISTANCE DU GERMOPLASME DE TOURNESOL À LA SORTE D'INSECTE *Nupserha* sp. near *vexator* (Pascoe)

RÉSUMÉ

Au moins 251 espèces d' insectes ou d' acariens sont connus pour attaquer le tournesol dans le monde. Actuellement, une chenille foreuse de la tige apparaît de façon régulière comme un insecte nuisible dans la région de Marathwada [M.S., Inde). Il s'agit d'un coléoptère proche de *Nupserha vexator* (Pascoe) appartenant à la famille des *Cerambycidae*: *Lamiinae*. Le screening de lignées de tournesol a été conduit au cours des cinq dernières années pour identifier des sources de résistance à exploiter ultérieurement dans les programmes d'amélioration génétique. Un ensemble de 100 lignées du programme coordonné de recherche pan-indien ont été reçu annuellement de 2002 à 2006 pour évaluer les sources de résistance aux principaux insectes nuisibles. Le travail de screening a été conduit à la Station de Recherche sur le Oléagineux de Latur [M.S. Inde] qui a été identifiée comme un point chaud pour la chenille foreuse de tige du tournesol. Les réactions des lignées ont été classifiées du niveau "sain" au niveau "plus de 80% d'attaque", ce qui indique la présence d'une variabilité pour la réponse aux attaques de la chenille foreuse de tige.