Research Note

ALLELOPATHIC EFFECTS OF SEVEN WEED SPECIES ON PUMPKIN (CUCURBITA MOSCHATA) UNDER GREENHOUSE CONDITIONS[1,2]

Weed interference (competition and allelopathy) accounts for crop losses and lower yields and quality. Weeds compete with crop plants for light, soil nutrients, moisture, carbon dioxide; they can also produce and release in the environment exudates that may inhibit other plants.[3] Almodóvar et al.[4] found a decrease of more than 50% in pumpkin yields when weeds grew freely in association with the crop.

In 1985, a greenhouse trial was conducted at the Lajas Agricultural Experiment Substation to determine possible allelopathic effects of seven weed species on pumpkin. The weed species were *Parthenium hysterophorus* L., *Echinochloa colonum* L., *Amaranthus dubius* Mart., *Sorghum halepense* (L.) Per., *Euphorbia heterophylla* L., *Rottboelia exaltata*, and *Trianthema portulacastrum* L. Seedlings of weeds about 15 cm in height (3 true leaves) were collected in the field and transplanted to a system similar to one utilized by Pope et al.[5] with a 5.1-cm I.D. PVC drain pipe and fittings. The complete system consisted of 10 "T" joints held together by 11 pipe sections, each 15.24 cm long, one elbow joint at one end and one PVC lid at the other end. The inverted "T" joints served as pots for holding the growth medium and provided support to the weed seedlings. The elbow joint served as the main receptacle for adding water or a nutrient solution. A piece of aluminum mesh was placed between the "T" joints to hold the growth medium and to let the root exudates drain through the main pipe. The lid at the end of the pipe prevented the loss of the solution and was removed whenever the exudates were recovered for further use. The PVC system was kept in place in a wooden rack (fig. 1).

Two weed seedlings of individual species were transplanted into each of the 10 "T" joints in each system on 10 July 1985. The growth medium was a mixture (1:1:1 v/v) of perlite, vermiculite and washed river sand. Seeds of pumpkin cv. Borinquen were sown the same day in 12-cm plastic pots in the same growth medium. After germination, only one pumpkin seedling was left in each pot.

On August 9, the weed seedlings were watered with a 20-20-20 (N, P_2O_5, K_2O) nutrient solution (one tablespoonful per gallon of water). The nutrient solution was then applied thereafter daily to weeds and pumpkin plants.

On August 12, exudates from weed roots were collected and applied to juvenile pumpkin plants at the rate of 60 cm³/pot.

[1]Manuscript submitted to Editorial Board 13 October 1987.

[2]Research conducted by Carmen D. Guzmán as part of a M.S. thesis, Crop Protection Dept., Univ. P. R., Mayagüez Campus.

[3]Klingman, G. L. and F. Ashton, 1982. Weed Science: Principles and practices. John Wiley and Sons. Pp. 4–6, 28–9.

[4]Almodóvar-Vega, L. M. Díaz Rivera and N. Semidey Laracuente, 1988. Evaluation of diquat for postemergence weed control in pumpkin (*Cucurbita moschata*). *J. Agric. Univ. P. R.* 72 (2): 285–90

[5]Pope, D. F., A. C. Thompson and A. W. Cole, 1985. Phytotoxicity of root exudates and leaf extracts of nine plant species. ACS Symposium Series 268, The Chemistry of Allelopathy, American Chemical Society, Washington, D. C. Pp. 219–34.

FIG. 1.—PVC system for collecting exudates from weed roots.

FIG. 2.—To the right pumpkin seedlings treated with *Parthenium hyterophorus* root exudates 3 alternate days per week or 6 weeks. Seedlings were affected more than when treated with *Sorghum halepense* exudates.

TABLE 1.—*Effect of root exudates from various weeds on vine length and dry weights of pumpkin* (Cucurbita moschata) *cv. Borinquen*

Treatment[2]	Weeds[1]						
	PTNHY	ECHCO	AMADU	SORHA	EPHAL	ROOEX	TRTPO
	Vine length (cm)[3]						
0	251.3 a	251.3 a	251.3 a	251.3 a	251.3 a	251.3 a	251.3 a
3	73.5 b	193.5 b	84.2 b	105.3 b	96.2 b	91.2 b	74.1 b
5	83.5 b	90.5 b	90.2 b	115.9 b	115.9 b	100.2 b	81.3 b
	Dry weight (g)[3]						
0	70.3 a	70.3 a	70.3 a	70.3 a	70.3 a	70.3 a	70.3 a
3	48.3 b	57.3 b	54.3 b	58.2 b	53.2 b	51.0 b	41.7 b
5	49.9 b	50.2 b	55.1 b	59.3 b	59.0 b	53.9 b	48.3 b

[1]PTNHY = *Parthenium hysterophorus*, ECHCO = *Echinochloa colonum*, AMADU = *Amaranthus dubius*, SORHA = *Sorghum halepense*, EPHAL = *Euphorbia heterophylla*, ROOEX = *Rottboellia exaltata* & TRTPO = *Trianthema portulacastrum*.

[2]0 = no exudates added; 3 = exudates applied in 3 alternate days for 6 weeks; and 5 = exudates applied during 5 consecutive days for 6 weeks.

[3]Average of three replications. Values in columns followed by the same letters do not differ significantly at P=0.05, Duncan's multiple range test.

For each weed species, three exudate treatments were administered: no exudates (tap water plus nutrient solution); exudates on 3 alternate days (Monday, Wednesday, Friday); and exudates on 5 consecutive days, Monday through Friday for 6 weeks. All treatments were replicated 3 times. Exudates were collected in opaque plastic containers; unused portions were kept under refrigeration until needed.

At the beginning of the experiment, pumpkin vine lengths were recorded. On September 23, final vine lengths and fresh plant weights were taken. To record dry weights, we oven dried plants at 60° C for a 24-hr period.

Table 1 summarizes the results of this study. *Vine length*: the pumpkin vines in the check treatment (no exudate) were significantly longer (251.3 cm) than the plant vines treated with weed root exudates. Root exudates applied on 3 alternate days per week caused a decrease in vine length from 105.3 cm (*S. halepense*) to 73.5 cm (*P. hysterophorus*) (fig. 2). Root exudates applied for 5 consecutive days per week caused reductions in vine length from 115.9 cm (*S. halepense*) to 81.3 cm (*T. portulacastrum*). No statistical differences in vine length were detected between 3 and 5 exudate applications per week for 6 consecutive weeks. *Dry weight*: the average dry weights of pumpkin (70.3 g) in the check treatment (no exudates) were significantly greater than those of pumpkin plants treated with root exudates. Root exudates applied for 3 alternate days per week caused reductions from 58.2 g (*S. halepense*) to 41.7 g (*T. portulacastrum*) in pumpkin dry weight. Root exudates applied for 5 consecutive days caused reductions in pumpkin from 59.3 g (*S. halepense*) to 48.3 g (*T. portulacastrum*). No statistical differences in pumpkin dry weights were detected among treatments of 3 or 5 exudate applications per week for 6 consecutive weeks.

The results of this experiment suggest that the 7 weed species caused adverse allelopathic effects on pumpkin. Additional studies with other weeds are suggested for future investigation. Chemical analyses of root exudates are necessary for identification of the allelopathic chemicals involved.

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